Nuclear Regulatory Commission (10 CFR Part 73) and U.S. Department of Transportation (49 CFR Part 173) regulations both include requirements to ensure the physical security and protection of shipments from diversion and attack. For the Final EIS, DOE reexamined, for both rail and truck casks, the consequences of an attack that results in a release of material (in other words, the cask's shield wall is penetrated)(see Section 6.2.4.2.3 of the EIS), and estimated consequences exceeded those presented in the Draft EIS. Differences in the consequences between the Draft EIS and the Final EIS are due to using "representative" spent nuclear fuel isotopics (verses "typical" in the Draft EIS) and an escalation of impacts to represent population growth to 2035. In addition, in the Draft EIS, the consequences of the sabotage event were bounded by those of the maximum reasonably foreseeable accident.

In the Final EIS, DOE estimated that the greatest consequences would occur if the sabotage event occurred in the center of a highly populated metropolitan area. The dose from such an event to a maximally exposed individual (about 110 rem over the person's lifetime) would increase his or her lifetime risk of a fatal cancer from about 23 percent to about 28 percent. However, doses to most affected individuals would be much lower than that to the maximally exposed individual; these individuals' increased risk of a latent fatal cancer would also be lower. It was not predicted that there would be any prompt fatalities from very high levels of exposure, and immediate health consequences from radiation exposure would be unlikely, but by combining the large number of small individual risks in the population of a metropolitan area, DOE estimated that a sabotage event could lead to as many as 48 latent fatal cancers. Although not estimated in the analysis, injuries and deaths from blast effects of a device that might be used would be expected for individuals who would be as close to the event as the hypothesized maximally exposed individual. However, exposure to radioactive materials sufficient to lead to an individual lifetime dose of 110 rem could result in a need for medical attention. DOE designed the analyses to identify the maximum consequences that a severe accident that could reasonably be expected to produce (reasonably expected is defined as a likelihood greater than, but on the order of, 1 in 10 million in a year), but the analysis here did not make extreme assumptions that would identify the worst possible consequences that could be imagined.

DOE believes that a shipment of spent nuclear fuel or high-level radioactive waste would be an unlikely target in part due to the physical security measures imposed by the Nuclear Regulatory Commission regulations. Under certain conditions, armed escorts would either follow or ride in the truck cab or an escort railcar. DOE would monitor its spent nuclear fuel and high-level radioactive waste shipments through a satellite-based tracking system. Additional information on the physical protection of spent nuclear fuel and high-level radioactive waste during transportation can be found in Section M.7 of the EIS.

8.8 Transportation Analyses

8.8 (4383)
Comment - EIS001523 / 0002
The Yucca Mountain Repository Site should not be approved since a safe method for transportation of nuclear waste materials to the site has not been determined. In the Environmental Impact Statement (EIS), the DOE has not accurately assessed the potential risk of the proposed transportation methods of either rail or highway. Several factors that must be reconsidered and reevaluated are the frequency and severity of accidents, proposed population growth in the areas near the transportation routes, and a recent increase in traffic speeds. The potential environmental impact resulting from the transportation of waste to the site have also been underestimated in this statement due to incomplete and outdated data. The DOE needs to conduct more accurate and complete studies in order to formulate a more complete assessment of the potential risks.

Response
The Nuclear Regulatory Commission has determined that the transportation of radioactive materials is safe if the shippers follow Commission and U.S. Department of Transportation requirements. The history of radioactive material transport in this country has proven this to be correct. Future shipments would occur under the same regulations that have contributed to the safe transport of more than 2,700 shipments in this country over the last 30 years. The accident analysis includes estimates of the number of accidents that could occur during shipments, estimates of the radiological risk of transportation accidents for populations along transportation routes, and a description of the consequences of maximum reasonably foreseeable transportation accidents. The maximum reasonably foreseeable accidents have an estimated frequency of occurrence of about 2.8 per 10 million years for rail shipments under the mostly rail scenario analyzed in the EIS and 2.4 per 10 million years for the mostly

legal-weight truck scenario. DOE based its estimates of accident risks and consequences of maximum reasonably foreseeable accidents on data presented in a report issued by the U.S. Nuclear Regulatory Commission (Sprung, et al., 2000). The accident analysis in the EIS addresses accidents from all sources including long duration fires, high-speed impacts, airplane crashes, and mountain rollovers. Appendix J of the EIS provides additional detailed descriptions of the analyses. The analysis used the latest reasonably available data and methods as well as cautious but realistic assumptions. For example, DOE used forecasts of population growth to estimate populations along routes. For purposes of analysis, DOE used populations forecasted to 2035 in estimating impacts. In addition, in response to public comments, DOE has added information to, and improved the clarity of transportation sections in Chapter 6 and Appendix J. The additional information includes more specific data on along-route populations as well as additional information used in analyzing potential impacts on biological resources, land use, soils, aesthetics, cultural resources, noise, ground vibration, flood plains, wetlands, air quality, environmental justice, waste management, and socioeconomics.

8.8 (4833)
Comment - EIS001226 / 0007
Locally, Illinois is expected to receive the third largest number of shipments as many as 13,000 over the next 30 years, or an average of 8 per week, every week, for 30 years, all requiring costly escort services.

Response
As presented in Section J.4 of the EIS, the number of legal-weight truck shipments through Illinois used by DOE to estimate impacts is about 38,500. About 5,300 would originate in the State. Illinois presently charges a fee of $2,500 per cask for truck shipments and a fee of $4,500 for the first cask and $3,000 for each additional cask for train shipments. Presumably, these fees adequately cover the costs of the current Illinois inspection and escort program. Should the repository transportation program go forward, DOE would consult with affected states on activities and fees appropriate at the time.

8.8 (12091)
Comment - EIS002307 / 0005
Section 6 of the DEIS is incorrect in its analysis of transportation safety because the DEIS users average weather conditions rather than conditions that would produce the greatest effects.

Response
The objective of the analyses in the EIS is to produce realistic yet conservative estimates of risks, not the largest possible estimates of risks as suggested by the commenter. The analysis provided in Section 6.2.4 of the EIS uses cautious assumptions and the latest reasonably available methods and data to provide conservative estimates of the potential radiological consequences of severe accidents and successful sabotage attacks on spent nuclear fuel shipments. The details of the calculations are provided in Section J.1.4.2. There could be specific locations along the transportation corridors in Nevada leading to the Yucca Mountain Repository that appear to be more vulnerable to an accidental release of radioactive material from a shipping cask. However, the computer models and data used in the accident consequence assessments result in estimates that consider the associated range of any location-specific conditions. Examples include the assumption that maximum reasonably foreseeable accidents would occur in the center of highly populated urban areas; evaluation of dose received by maximally exposed individuals (which addresses close proximity of the highway to hotels, casinos, retail businesses, schools, churches and residences); use of low-probability weather conditions that lead to the greatest consequences for maximum reasonably foreseeable accidents; and the assumption that no medical or other interdiction would occur to reduce concentrations of radionuclides absorbed or deposited in human tissues after a potential accident.

8.8.1 GENERAL

8.8.1 (172)
Comment - 11 comments summarized
Commenters said that DOE's analysis of transportation impacts is unrealistic because it is overly conservative. By considering almost every possible accident scenario during spent nuclear fuel and high-level radioactive waste transport, DOE has given credence to the virtually impossible and has, therefore, overestimated the impacts of transporting to Yucca Mountain. For example, the "maximum reasonably foreseeable accident" scenario modeled in the EIS has a likelihood of occurrence of about 1.4 in 10 million years. Considering that spent nuclear fuel and

high-level radioactive waste would be transported for only about 24 years, the chances that such a "worst case accident" could occur are essentially zero–less than the chances of a loss of life due to a meteor impact which has a probability of occurrence of 1 in 100,000 years (DIRS 107795-NRC 1975). These commenters cited the safety record of the commercial nuclear power industry during the past 35 years, during which time about 3,000 shipments of spent fuel have been transported across U.S. highways and railroads with no injuries, fatalities, or environmental damage. The EIS should take into account this enviable safety record, rather than using an ultraconservative accident scenario–one that is likely to occur 1.4 times in 10 million years.

Response
DOE believes that the EIS is consistent with National Environmental Policy Act and NWPA requirements. The level of information and analyses, the analytical methods and approaches used to represent conservatively the reasonably foreseeable impacts, and the use of bounding assumptions to address incomplete or unavailable information or uncertainties, provide a meaningful assessment of environmental impacts consistent with the applicable requirements. DOE agrees with the comment that maximum reasonably foreseeable accidents analyzed in the EIS are extremely unlikely. Analyzing such accidents, nevertheless, provides useful information for decisionmakers and the public, and demonstrates that DOE took a hard look at the potential risks.

In March 2000, the Nuclear Regulatory Commission published *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung 2000). The purpose of the study was to reexamine the risks associated with the transport of spent nuclear fuel by truck and rail and compare the results to those published in *Final Environmental Impact Statement on the Transportation of Radioactive Material by Air and Other Modes* (DIRS 101892-NRC 1977) and *Shipping Container Response to Severe Highway and Railway Accident Conditions* (DIRS 101828-Fischer et al. 1987). The Draft EIS used techniques and assumptions based on Fischer et al. (1987). The new Nuclear Regulatory Commission study concluded that both NRC (1977) and Fischer et al. (1987) made a number of very conservative assumptions about spent nuclear fuel and cask response to accident conditions, which caused their estimates of accident source terms, accident frequencies, and accident consequences to be very conservative. The new study concluded:

"Based on this more detailed analysis, cask leakage is found to be even less likely than the estimates of the Modal Study, and retention of particles and condensable vapors by deposition onto cask interior surfaces is found to be substantial. Accordingly, both source term probabilities and magnitudes decrease further, and consequently accident population dose risks are reduced further by factors of 10 to 100." (DIRS 152476-Sprung et al. 2000)

In response to comments, DOE has updated the EIS transportation impact analysis to incorporate some of the findings of the updated Nuclear Regulatory Commission analysis. Sections 6.2.4 and J.1.4 of the EIS concerning analyses of transportation accidents have been revised to incorporate data from that analysis (DIRS 152476-Sprung et al. 2000). The EIS no longer relies on the data from the Modal Study, with the exception of the data used in Sprung et al. (2000). This report contains revised estimates of probable releases from spent nuclear fuel casks during severe transportation accidents that involve long duration fires accompanied by high impact forces.

The Nuclear Regulatory Commission is considering including an assessment of the importance of human factors in cask design, manufacturing, and use in its planned Package Performance Study. The planned study, which is scheduled for completion in 2004, will provide an updated evaluation of the level of safety provided by spent nuclear fuel transport packages under a variety of railway and highway accident conditions.

8.8.1 (187)
Comment - 5 comments summarized
Commenters were critical of the RADTRAN model used to analyze transportation risks, stating that it does not adequately evaluate radiological impacts to populations along transportation routes. Commenters were unconvinced that the outputs of the model truly represent the impacts of spent nuclear fuel and high-level radioactive waste transportation because the model uses little site-specific information. Some said that the EIS should describe the underlying assumptions and shortcomings inherent in the RADTRAN 4 model and justify its use in the EIS, including if and how the model is applicable to undeveloped routes where spent nuclear fuel and high-level radioactive waste transport vehicles would pass slowly along narrow roadways through populated areas close to businesses and residences. Some said that because no database exists for such a large and long-lived shipping

campaign, the risk numbers generated by RADTRAN might be fundamentally flawed, and there is no scientific basis for proving whether the estimated risks are too low or too high.

Commenters identified specific flaws in the RADTRAN 4 model, stating that it is (1) outdated compared to even the most rudimentary desktop Geographic Information Systems, (2) not able to verify the worst possible threats, and (3) not sufficiently sensitive to local conditions such as the actual location of population centers and system operating characteristics such as average speeds and stop times of heavy-haul trucks in local communities. Commenters said that individuals who reside, work, or attend school at certain locations within 6 to 40 meters (20 to 130 feet) of a spent nuclear fuel and high-level radioactive waste route could receive exposures in excess of the average annual dose of background radiation. DOE has failed to investigate whether such conditions exist near school zones and pedestrian crossings, left turn lanes and at traffic signals, congested intersections, and uphill grades.

Others requested site-specific analyses, including a recalculation of the annual and cumulative collective dose and maximum individual dose to people in Tonopah and Goldfield assuming that each heavy-haul truck would travel at an average speed of 8 kilometers (5 miles) per hour and would stop at certain intersections for 2 to 5 minutes. The analysis must consider the actual location of all occupied buildings and people within 400 meters (0.25 mile) of the route, including children in schools and nonresidents in hotels and commercial establishments.

Response

In this EIS, DOE has used computer models it has used in previous EISs and other studies. These models are widely accepted by the national and international scientific and regulatory communities. For instance, DOE selected the RADTRAN 5 computer program to estimate radiological impacts to populations from incident-free transportation and from accidents. RADTRAN, which was originally developed by Sandia National Laboratories in the late 1970s, has been used in many DOE EISs, and it has undergone periodic review and revision. In 1995, an independent review of RADTRAN 4 (immediate predecessor to RADTRAN 5) demonstrated that it yielded acceptable results when compared to "hand" calculations. More recently, an independent review found that RADTRAN 5 overestimates the measured radiation dose to an individual from moving radiation sources. The RADTRAN 5 analyses included the inhalation, external exposure, resuspension, and ingestion pathways.

To manage the large amounts of transportation data used in the EIS, DOE chose to use database software, not a geographic information system. However, a geographic information system was used to generate the maps presented in Appendix J of the EIS and to estimate populations along routes in Nevada.

Substantial amounts of site-specific data were used in the RADTRAN 5 analyses. For example, *Road Upgrades for Heavy Haul Truck Routes - Design Analysis* (DIRS 154448-CRWMS M&O 1998) includes tables of the speeds and times used for every section of highway for heavy-haul trucks for the entire route from the intermodal facility to the repository. It shows that travel speeds at intersections and in towns such as Tonopah and Goldfield, are as low as 8 kilometers (5 miles) per hour. However, DOE does not believe it necessary to consider population characteristics on a community-by-community basis to determine potential public health and safety impacts from the transportation of spent nuclear fuel and high-level radioactive waste. The use of widely accepted analytical tools, latest reasonably available information, and cautious but reasonable assumptions if there are uncertainties, offer the most appropriate means to arrive at conservative estimates of transportation-related impacts.

In response to comments, additional information on potential state-specific routes and local and regional impacts are provided in Section J.4 of the EIS. The EIS includes estimated public health impacts along transportation routes. This analysis accounts for factors such as the locations of commercial establishments and residences.

DOE believes that the mostly rail case, in which more than 95 percent of spent nuclear fuel and high-level radioactive waste would be shipped by rail, would most closely approximate the actual mix of truck and rail shipments. In reaching this conclusion, DOE has assessed the capabilities of the sites to handle larger (rail) casks, the distances to suitable railheads, and historic experience in actual shipments of nuclear fuel, waste, or other large reactor-related components. In addition, DOE considered relevant information published by sources such as the Nuclear Energy Institute and the State of Nevada.

Nevertheless, in response to comments, DOE has analyzed the effects of different mixes of rail and truck shipments. The results of this analysis confirm the Department's estimate that the mostly rail and mostly legal-weight truck

scenarios represent a reasonable range (lower and upper bound) of potential environmental impacts from the transportation of spent nuclear fuel and high-level radioactive waste.

8.8.1 (189)
Comment - 5 comments summarized
Several commenters stated that the EIS was inadequate because it presented health impacts only in terms of deaths. There was no assessment of quality of life, traffic-related injuries, genetic effects, or other potential negative health, environmental, and economic impacts.

Response
As discussed in Section F.1.1.5 of the EIS, cancer is the principal potential risk to human health from exposure to low or chronic levels of radiation. It is well accepted within the risk assessment and health physics community to use latent cancer fatalities as the measure of impact from radiation exposure. However, other health effects such as nonfatal cancers and genetic effects can occur as a result of chronic exposure to radiation. These are discussed in Section F.1.1.5.

The transportation analyses in the EIS present the total impact of the Proposed Action and the No-Action Alternative. Fatalities were used as the measure of the total impact because non-radiation-related traffic fatalities can be combined with radiation-related latent cancer fatalities to yield an estimate of the total number of fatalities for the Proposed Action and the No-Action Alternative. In contrast, combining non-radiation-related measures of impact such as traffic-related injuries, illnesses, and other environmental impacts with radiation-related latent cancer fatalities would not yield an easily understandable estimate of total impacts. For the same reason, genetic effects, nonfatal cancers, and other radiation effects were not included in the estimates of the total impact.

Based on comments, a discussion of the economic impacts of severe transportation accidents has been added to Section J.1.4.2.5 of the EIS.

DOE believes that the EIS adequately analyzes transportation-related impacts that could result from the Proposed Action. DOE also believes that the EIS provides the information necessary to make decisions on the basic approaches to transporting spent nuclear fuel and high-level radioactive waste (either rail or truck shipments), as well as the choice among alternative rail corridors in Nevada, if the site was recommended and approved. See the introduction to Chapter 8 of this Comment-Response Document for more information.

8.8.1 (192)
Comment - 5 comments summarized
Several commenters objected to the comparisons made of the impacts of transporting spent nuclear fuel and high-level radioactive waste to the proposed repository with the cumulative transportation impacts in Section 8.4.1 and with cancer statistics in Section 6.2.4.2.1. Another commenter stated that the conclusion of "no significant impacts" was based on averaging transportation impacts across the entire U.S. population. Another commenter stated that the comparisons of Modules 1 and 2 with the Proposed Action are invalid because there are 600 percent more shipments and only 17 percent additional impacts. Several commenters stated that comparing transportation impacts to national cancer statistics is invalid. Another commenter stated that 1943 is an arbitrary date and inappropriate for beginning the calculation of the cumulative impacts of transporting radioactive materials. The commenter also stated that dividing the total cancer fatalities by 100 years is misleading. Commenters stated that these comparisons caused the skepticism that the public has about DOE and the project and that the use of statistics and comparisons in this manner is deceitful, deceptive, scandalous, and a twist on the truth.

Response
DOE believes that comparing the transportation impacts calculated in the EIS with national cancer incidence statistics is valid and properly places any transportation-related increased risk of contracting a fatal cancer in perspective to the cancer risks inherent in everyday life. Section 8.4 of the EIS provides the results of cumulative impact analyses conducted to ensure that the environmental impacts of the Proposed Action (or alternative actions) and other actions that involve the same regions or resources are provided to decisionmakers. The information is used to minimize or avoid adverse consequences and to develop an appropriate mitigation strategy and monitor its effectiveness. In developing these comparisons and cumulative impacts, attempts were made to ensure that the comparisons were on a consistent basis.

The transportation impacts in the EIS were not averaged over the entire population of the United States. In addition, the exposed population was not 50 million people. Rather, the transportation impacts were integrated over the exposed population along the transportation routes analyzed in the EIS. As discussed in Sections 6.2.3.1 and 6.2.3.2 of the EIS, these exposed populations ranged from 10 million for truck shipments to 16 million for rail shipments. For perspective, the population of the United States was about 250 million in 1990 and 280 million in 2000. In addition, the cumulative impacts in Section 8.4.2.1 were not divided by 100 years, as suggested by one commenter. All of the impacts presented in this section are estimates of the sums of impacts from past, present, and reasonably foreseeable actions, and no attempt was made to divide them by 100 years.

With regard to the comment on Module 1 and 2 impacts, the commenter is incorrect in the interpretation that the impacts only increase 17 percent while the numbers of shipments increase by 600 percent (The actual increases in the number of shipments for Modules 1 or 2 are approximately 200 percent, as listed in Table J-1 of the EIS). As listed in Table 8-58, for example, the collective worker dose for the mostly legal-weight truck scenario would be 14,000 person-rem for the Proposed Action and 28,000 person-rem for Module 1 or 2. This represents about 100-percent higher impacts for Module 1 or 2. The number of shipments would increase by about the same amount, as listed in Table J-1. Smaller percentage increases, noted by the commenter, are observed only when cumulative doses from past transportation activities are added to the impacts of the Proposed Action and Modules 1 or 2. This is because the impacts of general radioactive material transportation not related to a particular action (310,000 person-rem are estimated in Table 8-58) are much larger than the Proposed Action and Modules 1 or 2.

DOE used 1943 as a starting point for the cumulative impacts analysis because this corresponds to the time when spent nuclear fuel shipments between nuclear facilities started.

8.8.1 (196)
Comment - 15 comments summarized
Several commenters stated that the EIS significantly, woefully, and systematically underestimates transportation risk. The program involves an unprecedented number of trucks and trains. One commenter stated that use of old, cool spent fuel misrepresents the true risk. A commenter stated that detailed studies of routes should be included. The Nation should wait for 50 years to allow the spent fuel to decay to less radioactive levels. Commenters stated that the generic analyses do not account for potentially long stop times, slow speeds, intersections, traffic lights or unique highway characteristics, and community characteristics, such as locations of hotels, schools, and churches. In addition, the corridor widths are too narrow for radiological impact analyses. Another commenter stated that the 400-meter (0.5-mile) corridor used in the incident-free risk assessment underestimates risks. Another expressed concern with large amounts of long-lived radioactive materials in spent nuclear fuel and potential exposures to unshielded fuel elements.

Response
DOE does not believe it necessary to consider population characteristics on a community-by-community basis to determine potential public health and safety impacts from the transportation of spent nuclear fuel and high-level radioactive waste. The use of widely accepted analytical tools, latest reasonably available information, and cautious but reasonable assumptions if there are uncertainties, offer the most appropriate means to arrive at conservative estimates of transportation-related impacts.

In this EIS, DOE has used computer models it has used in previous EISs and other studies. These models are widely accepted by the national and international scientific and regulatory communities. For instance, DOE selected the RADTRAN 5 computer program to estimate radiological impacts to populations from incident-free transportation and from accidents. RADTRAN, which was originally developed by Sandia National Laboratories in the late 1970s, has been used in many DOE EISs, and it has undergone periodic review and revision. In 1995, an independent review of RADTRAN 4 (immediate predecessor to RADTRAN 5) demonstrated that it yielded acceptable results when compared to "hand" calculations. More recently, an independent review found that RADTRAN 5 overestimates the measured radiation dose to an individual from moving radiation sources.

To ensure that the EIS analyses reflect the latest reasonably available information, DOE has either incorporated information that has become available since the publication of the Draft EIS or modified existing information to accommodate conditions likely to be encountered over the life of the Proposed Action. For example, the analysis in

the Draft EIS relied on population information from the 1990 Census. In this Final EIS, DOE has scaled impacts upward to reflect the relative state-by-state population growth to 2035, using 2000 Census data.

Although the EIS analyses are based on the latest reasonably available information and state-of-the-art analytical tools, not all aspects of incident-free transportation or accident conditions can be known with absolute certainty. In such instances, DOE has relied on conservative assumptions that tend to overestimate impacts. For instance, DOE assumed that the radiation dose external to each vehicle carrying a cask during routine transportation would be the maximum allowed by U.S. Department of Transportation regulations. Similarly, DOE assumed that an individual, the "maximally exposed individual," would be a resident living 30 meters (100 feet) from a point where all truck shipments would pass. Under these circumstances, the maximally exposed individual would receive a dose of about 6 millirem from exposure to all truck shipments (6 millirem represents an increased probability of contracting a fatal cancer of 3 in 1 million). Although it can be argued that individuals could live closer to these shipments, it is highly unlikely that an individual would be exposed to all shipments over the 24-year period of shipments to the repository, even though DOE incorporated this highly conservative assumption in the analysis.

However, in response to comments, DOE has considered locations at which individuals could reside nearer the candidate rail corridors and heavy-haul truck routes in Nevada as a way of representing conditions that could exist anywhere in potentially affected communities. For example, DOE assumed that a maximally exposed individual could reside as close as 4.9 meters (16 feet) to a candidate heavy-haul truck route. During the 24-year period of repository operations this maximally exposed individual would receive an estimated dose of about 29 millirem, resulting in an increased fatal cancer probability of 2 in 100,000.

These exposures would be well below those received from natural background radiation, would not be discernible even if corresponding doses could be measured, and would not add measurably to other impacts that an individual could incur. For comparison, the lifetime likelihood of an individual incurring a fatal cancer from all other causes is about 1 in 4.

Based on public comments, DOE has revised the spent nuclear fuel used in the transportation analysis to use spent nuclear fuel with less cooling time (15 years versus 26 years and fuel with higher activity (50,000 megawatt-days per MTHM rather than 40,000 megawatt-days per MTHM). The radionuclide inventory contained in spent nuclear fuel is presented in Appendix A of the EIS. The typical rail cask would contain 4.5 million curies of radioactive material and the typical truck cask would contain 800,000 curies. While it is true that spent nuclear fuel would be less radioactive in 50 years, the impacts from transporting spent nuclear fuel are already very low, so waiting 50 years would not provide a practical reduction in the already very low risks.

Unshielded spent nuclear fuel is hazardous and, for this reason, would be shipped in heavily shielded casks. The maximum radiation dose rate from a spent nuclear fuel cask would be about 10 millirem per hour at 2 meters (6 feet) from the transport vehicle. For perspective, the radiation dose from a single chest X-ray is about 8 millirem. Therefore, the radiation dose from a spent nuclear fuel cask is equivalent to a little more than one chest X-ray per hour and is much lower than a lethal radiation dose.

The 800-meter (0.5-mile) distance was used only for estimating the incident-free transportation impacts. Because radiation levels fall off rapidly with distance from the source, this distance is adequate for estimating exposures from incident-free transportation. Consistent with accident analyses conducted at nuclear powerplants, the EIS analyzes the impacts from transportation accidents out to 80 kilometers (50 miles).

DOE believes that the EIS adequately analyzes transportation-related impacts that could result from the Proposed Action. DOE also believes that the EIS provides the information necessary to make decisions on the basic approaches to transporting spent nuclear fuel and high-level radioactive waste (either rail or truck shipments), as well as the choice among alternative rail corridors in Nevada, if the site was recommended and approved. See the introduction to Chapter 8 of the Comment Response Document for more information.

8.8.1 (198)
Comment - 3 comments summarized
Commenters stated that DOE has underestimated the environmental damage that would result from routine transportation and spills of hazardous waste. The EIS used incomplete and outdated data and underestimated the

effects on groundwater and surface water, community water supplies, land use, and disruption of wild game habitat. DOE must examine the entire study area rather than limit the impact assessment to the area within the right-of-way. Another commenter requested information on environmental contamination outside the rail corridors, the dose rate to people living outside the corridors, and the long-term effects on animals, waterways, and wetlands.

Response

Section 6.2 of the EIS describes impacts of preparing to transport and transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain. The impacts are those that could occur to people and environmental media, including groundwater and surface water, land use, wetlands, biological resources, cultural resources, and effects on domestic and wild animals. DOE does not believe it necessary to consider population characteristics on a community-by-community basis to determine potential public health and safety impacts from the transportation of spent nuclear fuel and high-level radioactive waste. The use of widely accepted analytical tools, latest reasonably available information, and cautious but reasonable assumptions if there are uncertainties, offer the most appropriate means to arrive at conservative estimates of transportation-related impacts.

In this EIS, DOE has used computer models it has used in previous EISs and other studies. These models are widely accepted by the national and international scientific and regulatory communities. For instance, DOE selected the RADTRAN 5 computer program to estimate radiological impacts to populations from incident-free transportation and from accidents. RADTRAN, which was originally developed by Sandia National Laboratories in the late 1970s, has been used in many DOE EISs, and it has undergone periodic review and revision. In 1995, an independent review of RADTRAN 4 (immediate predecessor to RADTRAN 5) demonstrated that it yielded acceptable results when compared to "hand" calculations. More recently, an independent review found that RADTRAN 5 overestimates the measured radiation dose to an individual from moving radiation sources.

To ensure that the EIS analyses reflect the latest reasonably available information, DOE has incorporated information that has become available since the publication of the Draft EIS or modified existing information to accommodate conditions likely to be encountered over the life of the Proposed Action. For example, the analysis in the Draft EIS relied on population information from the 1990 Census. In this Final EIS, DOE has scaled impacts upward to reflect the relative state-by-state population growth to 2035, using 2000 Census data.

The analysis of national transportation of spent nuclear fuel and high-level radioactive waste evaluated impacts to populations along routes shipments could use.). DOE concluded that the impacts in these resource areas from nationwide transportation (outside Nevada) would not be discernible because shipments would use existing highways and railroads and would contribute only minimally to the volume of national transportation (0.007 percent of railcar kilometers and 0.008 percent of truck kilometers).

In Nevada, where a new branch rail line could be constructed or roads could be upgraded for use by heavy-haul trucks and an intermodal transfer station could be built and operated, the analysis addressed impacts on land use and ownership; air quality; hydrology; biological resources (including wild game habitat) and soils; public health and safety; socioeconomics; noise; cultural resources; aesthetics; utilities, energy, and materials; waste management, and environmental justice (Sections 6.3.2 and 6.3.3 of the EIS). In general, the impacts were assessed for regions of influence that extend beyond the area that would be within a rail corridor or highway right-of-way or site area of an intermodal transfer station (Sections 6.3 and J.1 discuss regions of influence used in the analyses). For example, human health effects from accidents were evaluated for populations living within 80 kilometers (50 miles) of a route (see Section 6.3.1.3.2).

As discussed in Section J.1.4.2.1 of the EIS, there would be no environmental contamination unless a severe accident resulted in a breach of containment of the shipping cask. Under incident-free conditions, there would be no environmental contamination because the spent nuclear fuel and high-level radioactive waste would not be released from shipping casks. In addition, the radiation emitted from shipping casks under incident-free conditions would have no discernible impacts on any ecological attribute (for example, groundwater and surface water, air quality, and wildlife habitat).

Plants and animals are no more sensitive to the effects of radiation than humans. Acute and chronic radiation doses that do not adversely affect humans are not known to affect terrestrial species of plants and animals. The International Atomic Energy Agency reports that there is no convincing evidence that indicates that the current

radiological dose standards for humans would harm animal or plant populations (DIRS 103277-IAEA 1992). In other words, if humans are adequately protected, plants and animals are likely to be adequately protected.

The EIS does not specifically analyze a transportation accident involving contamination of surface water or groundwater. Analyses performed in previous EISs (see Section 1.5.3 and Table 1-1 of this EIS) have consistently shown that the airborne pathway has the greatest potential for exposing large numbers of people to radioactive material in the event of a release of radioactive materials during a severe transportation accident. An analysis of the potential importance of water pathway contamination for spent nuclear fuel transportation accident risk using a worst-case water contamination scenario (DIRS 157052-Ostmeyer 1986) showed that the impacts of the water contamination scenario were about one-fiftieth of the impacts of a comparable accident in an urban area.

The shipping casks used to transport spent nuclear fuel and high-level radioactive waste would be massive and tough with design features that complied with strict regulatory requirements that would ensure the casks performed their safety functions even when damaged. The casks would be designed to be watertight even after a severe accident. Furthermore, the high-level radioactive waste would be in a solid form (ceramics, metals, or glasses) that would not be easily dispersed.

Numerous tests and extensive analyses, using the most advanced analytical methods available, have demonstrated that casks would provide containment and shielding even under the most severe kinds of accidents. Since the publication of the Draft EIS, the Nuclear Regulatory Commission published *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000). Based on the revised analyses, DOE has concluded in the EIS that casks would continue to contain spent nuclear fuel fully in more than 99.99 percent of all accidents (of the thousands of shipments over the last 30 years, none has resulted in an injury due to release of radioactive materials). This means that of the approximately 53,000 truck shipments, there would be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less. The corresponding chance that such an accident would occur in any particular locale would be extremely low. Section J.1.4.2.1 of the EIS presents consequences for accidents that could release radioactive materials.

8.8.1 (918)
Comment - EIS000124 / 0012
I also think that the transportation issues need to be addressed much more widely. I agree with the former speakers that Pahrump needs a new opportunity to address this.

Response
DOE believes that the EIS provides the environmental impact information necessary to make certain broad transportation-related decisions, namely the choice of a national mode of transportation outside Nevada (mostly rail or mostly legal-weight truck), the choice among alternative transportation modes in Nevada (mostly rail, mostly legal-weight truck, or heavy-haul truck with use of an associated intermodal transfer station), and the choice among alternative rail corridors or heavy-haul truck routes with use of an associated intermodal transfer station in Nevada if the site was approved. However, follow-on implementing decisions, such as the selection of a specific rail alignment in a corridor, or the specific location of an intermodal transfer station in Nevada or the need to upgrade heavy-haul truck routes, would require additional field surveys, State and local government, and Native American tribal consultations, environmental and engineering analyses, and appropriate National Environmental Policy Act reviews.

8.8.1 (1007)
Comment - EIS000262 / 0003
The EIS needs to include a risk analysis comparing, at a national level, all probable primary and secondary shipment routes coming into Yucca Mountain. Again, absent information on the range of impacts expected to accrue to the project, we, as citizens, and the Federal and State decision makers expected to use the EIS, are left without the tools to weigh risks, evaluate alternatives, or recognize what constitutes an unavoidable transportation impact.

Route choice will affect the safety, cost and timing of transport operations. DOE needs to engage in a comprehensive study of this issue in order to develop a scientifically defensible, least-risk-based determination of routes. Private carriers should not be burdened with the responsibility to evaluate and choose routes. The preferred

corridors should be mapped by DOE and the required roadway and emergency response improvements identified. In this way, the total impact and cost of the project can be laid out for public review.

Response
Section 2.1.3.2 of the EIS describes the national transportation shipping scenarios. Section 6.2.3 analyzes the impacts of transporting spent nuclear fuel and high-level radioactive waste using two scenarios: mostly legal-weight truck and mostly rail. The routes selected for the analyses met U.S. Department of Transportation regulations (49 CFR 397.101) and conformed to railroad routing practices. While these might not be the routes used in the future because of infrastructure changes or other variables, they are representative and therefore the analyses provide sufficient information on which to make decisions. Appendix J provides state-by-state maps of routes used in the analysis. The maps include tables of numbers of shipments originating in and passing through the state and the impacts of incident-free and potential accidents from these shipments. State or tribal designated alternate routes meeting Federal regulations were considered in the analysis. Section 2.1.5 provides information on the cost of the Proposed Action including costs of waste acceptance, storage, and transportation (nationally, $4.5 billion, and within Nevada, $0.8 billion). These costs are based on the mostly rail implementing alternative. Detailed costs of specific routes and modes cannot be estimated until the modes and routes are identified and approved.

Chapter 6 and Appendix J of the EIS provide the impacts and methods used to derive the impacts of the various mode and route alternatives for the life of the project. Impacts and risks for individuals, populations, and a variety of situations and accident conditions are addressed.

Route selection would not be left to the carriers alone. The current concept is that the shipping contractors would select routes and submit them to DOE for approval prior to their submittal to the Nuclear Regulatory Commission. The route selection process is discussed in greater detail in Section M.3.2.1.2 of the EIS. Requirements and protocols to be followed by the contractors in developing and implementing emergency response plans are described in Sections M.3.2.2.5 and M.5. DOE is required by Section 180(c) of the NWPA to provide technical and financial assistance to states and Native American tribes to support training for emergency responders. Part of this support is the determination of needed training that is based on plans developed by responsible jurisdictions. DOE anticipates that training would cover procedures required for safe routine transportation of spent nuclear fuel and high-level radioactive waste, as well as procedures for dealing with emergency response situations. Training would be instituted before beginning shipments to the repository. Additional information of Section 180(c) requirements and other emergency response capabilities and responsibilities are provided in Sections M.5 and M.6.

8.8.1 (1259)
Comment - EIS000228 / 0003
The DEIS transportation section fails to address the "range of alternatives" as required by the Council on Environmental Quality (CEQ) (Council on Environmental Quality. "Forty Most Asked Questions Concerning CEQ's NEPA Regulations." Wash D.C.). The DEIS does not address bounding scenarios in assessing the transportation risk. Among the ranges of alternatives that should be included in the analysis are:

- the use of dedicated versus general rail freight,
- consolidated shipping that would remove all of the SNF [spent nuclear fuel] from one region of the country versus a diffuse shipping program that leaves most of the country affected for long periods of time (advocated by the DOE),
- the use of uniform cask types versus a mix of cask types (proposed by DOE),
- analysis of the health effects of the "shortest path" from the reactors versus the health effects of routes that avoid highly populated urban areas,
- the shipment of ten versus twenty-five year old spent fuel.

Response
Section J.2.3 of the EIS discusses these two options, and Table J-25 provides a comparison of dedicated and general freight shipment by rail. The analysis for Chapter 6 did not consider the type of train service that could be used to deliver shipments to Nevada, because the available data for rail accident and fatality rates from the U.S. Department of Transportation is insufficient for this purpose and because other information is not sufficient to address differences in the impacts that might arise from differences between the two types of service. The Department of Transportation data do not present accident information for different kinds of rail service. A qualitative comparison

of attributes of general rail freight to dedicated train service in Table J-25 and in Section J.2.3, which is based in part on results of a recent Department of Transportation study, does not indicate a clear advantage for the use of either type of rail service. Thus, impacts discussed in the EIS are estimated based on typical railroad operations. In these operations, railroads transport freight cars, including cars carrying hazardous materials, along with other freight in trains that average 67 cars in length. The Department believes the analysis presented in the EIS supports use of either general rail freight or dedicated train service.

As discussed in Section M.3 of the EIS, the Department has determined that contractors could be directed to use dedicated train service where it can be demonstrated to enhance operations efficiency and cost-effectiveness.

There are several factors that make "consolidated shipping" a nonviable alternative. DOE is required by the terms of the Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste (10 CFR Part 961) to assign priority to those waste generator sites whose fuel was discharged earliest. This is usually called the "Oldest Fuel First" priority. DOE must pick up fuel from sites designated by those waste generators with the oldest fuel regardless of the location. In addition, spent nuclear fuel would continue to be generated for many years after the repository begins operation; even if one region were cleared out early, additional shipments would have to be made as more spent nuclear fuel is generated.

All casks that would be used would be designed to meet Nuclear Regulatory Commission and U.S. Department of Transportation regulations, and approved by the Commission prior to use. DOE would rely on private industry to design, license, and fabricate the casks to be used to transport commercial spent nuclear fuel to the proposed repository at Yucca Mountain. Many of these casks have already been designed and some have been fabricated. Although these casks are not of a uniform design, the major handling and shipping parameters such as weight and size are essentially the same. DOE sees no benefit in attempting to impose a common design on all casks.

Highway routes would be selected in accordance with U.S. Department of Transportation regulations in 49 CFR 397.101 and as approved by the Nuclear Regulatory Commission following regulations in 10 CFR Part 73. Among other things, these regulations require the routes to be selected to reduce time in transit. Department of Transportation regulations require highway shipments to use Interstate System beltways and bypasses around cities although this might not be the "shortest path." Rail shipments would be routed over the best available track, to minimize the number of interchanges between railroads, and to minimize time in transit. This routing might or might not result in the "shortest path."

Based on comments received and DOE's additional review of technical documents and conduct of hazard analyses, the basis for the transportation impact analysis has been revised to consider commercial spent nuclear fuel that has median hazard. Spent nuclear fuel having median hazard would be discharged from a reactor approximately 14 years before shipment to Yucca Mountain. The radionuclide inventories of the representative spent nuclear fuel used in the analysis are presented in Tables A-9 and A-10 of the EIS. Five- or 10-year-old spent nuclear fuel shipped to the repository would be a small fraction of the total shipments. This is an example in which "average" data are used in the EIS as opposed to bounding assumptions. Consistent with Council on Environmental Quality regulations (40 CFR 1502.22), DOE is attempting to avoid compounding conservatisms, yielding unrealistic results, in analyzing accident scenarios. Other elements of the impact analyses (for example, radiation dose rates, atmospheric dispersion modeling, release fractions) are such that the transportation impact results presented in the EIS are representative, yet not so conservative that the true differences among alternatives are masked.

8.8.1 (1264)
Comment - EIS000228 / 0007
In 1995, the DOE indicated in a report Cited as a DEIS reference (OCRWM. "Nevada Potential Repository Preliminary Transportation Strategy Study 1." April 1995 P 10), that input from the affected counties would be a consideration in selecting a route through Nevada to Yucca Mountain. Clark County believes none of the implementing alternatives proposed in the DEIS are acceptable without further study. Clark County contends that without a detailed description of the packaging, handling, transportation, and mitigation systems necessary to implement the Yucca Mountain program it is impossible to assess the impacts of this program.

Response
DOE has identified mostly rail as its preferred mode of transportation, both nationally and in Nevada. At this time, however, the Department has not identified a preference among the five candidate rail corridors in Nevada. DOE believes that the EIS provides the environmental impact information necessary to make certain broad transportation-related decisions, namely the choice of a national mode of transportation outside Nevada (mostly rail or mostly legal-weight truck), the choice among alternative transportation modes in Nevada (mostly rail, mostly legal-weight truck, or heavy-haul truck with use of an associated intermodal transfer station), and the choice among alternative rail corridors or heavy-haul truck routes with use of an associated intermodal transfer station in Nevada if the site was approved. However, follow-on implementing decisions, such as the selection of a specific rail alignment in a corridor, or the specific location of an intermodal transfer station in Nevada or the need to upgrade heavy-haul truck routes, would require additional field surveys, State and local government, and Native American tribal consultations, environmental and engineering analyses, and appropriate National Environmental Policy Act reviews.

8.8.1 (1320)
Comment - EIS000340 / 0003
Many aspects of the Yucca Mountain Project don't seem to make much sense. For instance, the transportation of nuclear waste through residential streets greatly increases the risk of radiation to civilians.

Response
Highway routes would be selected in the future in accordance with the U.S. Department of Transportation regulations in 49 CFR 397.101. In addition, the routes would be submitted to the Nuclear Regulatory Commission for approval. The Department of Transportation regulations in 49 CFR 397.101 require that highway shipments use preferred routes, which are defined as Interstate System highways and beltways or bypasses around cities and alternative preferred routes designated by state or tribal routing agencies. A shipment could deviate from a preferred route only to pick up or deliver the shipment, or for required food, rest, or refueling stops, to make repairs, or in emergencies in which the preferred route is unavailable or unsafe.

8.8.1 (1546)
Comment - EIS000357 / 0005
Risk assessment of the waste isolation pilot project. Can the experience of transport of low-level nuclear waste and impacts be used as a model for the Yucca Mountain repository? Can this be used to assess community impacts and transport accident rates?

Response
Some experience gained from low-level waste transportation would be applicable to the transportation of spent nuclear fuel to the proposed repository. For example, estimated accident rates should not be significantly different, because both spent nuclear fuel and low-level waste transportation accident rates should not differ much from the general commerce truck and general freight rail accident rates used in the EIS. Other areas would not be applicable, such as the level of hazard of spent nuclear fuel compared to that of low-level waste, packaging and handling operations, types of shipping containers, security, escorts, and routing.

DOE experience with shipping transuranic waste to the Waste Isolation Pilot Plant is more like shipping spent nuclear fuel than would be experience in shipping low-level radioactive waste. Spent nuclear fuel transportation shares more fundamental features with the Waste Isolation Pilot Plant transportation program than with a low-level waste shipping program. For example, DOE ships transuranic waste in accident-resistant packages, uses the TRANSCOM shipment tracking and communication system, follows similar routing guidelines and transportation protocols (see Appendix M of the EIS), just as it would for spent nuclear fuel shipments. However, not every aspect of the transuranic waste shipping program is identical to the proposed spent nuclear fuel shipping program, such as remote handling requirements, the possibility of rail transport of spent nuclear fuel, internal packaging used, approval of routes by the U.S. Nuclear Regulatory Commission, and waste form characteristics (such as ignitability, gas generation, fissile material concentrations).

8.8.1 (2355)
Comment - EIS000645 / 0001
Although everybody here in Crescent Valley has addressed this because of the spur, first fire alarm that goes off in my head and heart is that existing rail line that is going to feed that spur goes through all four major cities in my

county. Ninety percent of our population is based on that cargo, that is Wendover, Wells, Elko, and Carlin. So right there and then I know that is something that we have to be concerned about.

Second point is that the main stopover for our area for crew changes, if that is the case that these trains would require crew changes, is in Elko. That is where all the major trains stop and all the crews stay. If they are allowed to have 48-hour stopover there, that means that these trains with hot loads will be sitting right there in the heart of the downtown area. I can empathize with people having homes up close to these rail lines. But I have an entire 35,000 people right there. And that's a very big concern to us.

Lastly, because of these range fires that we have had, we have had a lot of right-of-way fences destroyed. Now our commission has begged three different letters to have railroads to please replace your right-of-way fencing. They haven't responded to us once. I can imagine what would happen later on here if we had something like this and some right-of-way fencing was destroyed. It would take us forever to get this fencing back up, and God knows what would happen at that point.

We have had people killed on our rail lines here in Elko County. And I know there is many unexpected crossings we have. It goes through some very stiff terrain, over the Pequots and so on. High elevations, cold weather.

And if something happens, whether it is flash flooding, snow, or something, and these trains are backed up, where do they back up? Are they just going to stop at each one of our main cities and then we're going to have one of these trains sitting at each one of our towns?

Response
The EIS assessment of maximally exposed individuals considered stopovers at railyards (see Section J.1.3.2.2 and Table 6-9). The radiation dose to a resident 200 meters (660 feet) from a railyard and exposed for 20 hours to every shipment that passed would received as much as 0.31 rem over 24 years. This is a small radiation dose; approximately equal to the annual radiation dose this hypothetical individual would receive from natural background radiation in 1 year. It is conservative, in that this person would be unlikely to be present in an unshielded location for every passing shipment. DOE anticipates that potentially long stopovers to wait for adverse weather conditions would be rare.

Maintenance of existing rail rights-of-way, such as rebuilding damaged or destroyed fences, is the responsibility of the railroad. If DOE decided to build and operate its own branch rail line to connect the existing railroad with the proposed repository, it would be DOE's responsibility to maintain the right-of-way.

8.8.1 (2403)
Comment - EIS000674 / 0006
At the best, I think use of that route through Esmeralda and Nye County is going to cause a lot of people to get an extra 10 to 50 millirem per year just from heavy-haul trucks.

That's like two to five extra chest x-rays a year, assuming you've got a properly calibrated machine. That's a low enough exposure that no one can really see what the cancer impacts or the genetic impacts are. But it is a measurable dose to the general population that is like saying, "Let's increase your natural radiation from all sources by ten percent or more." That's something that the DEIS has to look at using different tools and different analytical techniques.

Use of a RADTRAN model is crude. It doesn't give you the kind of analysis you need.

Response
In responding to public comments regarding individuals in Nevada who live close to candidate transportation routes, DOE used information from a recent report prepared for the City of North Las Vegas (DIRS 155112-Berger Group 2000). This report presents suggested assumptions for a hypothetical maximally exposed individual who lived 15 meters (49 feet) from a roadway used by heavy-haul trucks and who would be present and stay at that location, when, over the 24 years, each shipment stopped for 1 minute. DOE believes that such an exposure scenario is highly unlikely and therefore unrealistic. Nonetheless, DOE estimated the maximum cumulative radiation dose to this hypothetical individual would be about 520 millirem over 24 years of the Proposed Action (see Section

J.1.3.2.2.1 of the EIS). This dose would lead to an estimated increase in risk of cancer of 1 in 4,000, over the individual's lifetime. The analysis in the EIS considered other maximally exposed individuals who could live along routes in Nevada. These included:

- A person in Alamo living in a residence approximately 5 meters (15 feet) from U.S. 93 where heavy-haul trucks could pass who could receive a dose of 25 millirem over 24 years

- A person who could be in the courthouse or fire station in Goldfield, Nevada approximately 5 meters (15 feet) from U.S. 95 where heavy-haul trucks could pass, who could receive a dose of 56 millirem over 24 years.

For perspective, cancer from all other causes is fatal to about 1 in 4 persons. DOE believes this increase in radiation exposure poses no undue risk to the population surrounding the proposed routes for heavy-haul trucks.

In this EIS, DOE has used computer models it has used in previous EISs and other studies (see Sections 6.2.1 and J.1.1). These models are widely accepted by the national and international scientific and regulatory communities. For instance, DOE selected the RADTRAN 5 computer program to estimate radiological impacts to populations from incident-free transportation and from accidents. RADTRAN, which was originally developed by Sandia National Laboratories in the late 1970s, has been used in many other previous DOE EISs, and it has undergone periodic review and revision. In 1995, an independent review of RADTRAN 4 (immediate predecessor to RADTRAN 5) demonstrated that it yielded acceptable results when compared to "hand" calculations (DIRS 101845-Maheras and Pippen 1995). More recently, an independent review found that RADTRAN 5 overestimates the measured radiation dose to an individual from moving radiation sources.

8.8.1 (2404)
Comment - EIS000653 / 0001
A thorough assessment of the impacts of the proposed action is necessary. We believe the Draft Environmental Impact Statement falls far short of this goal.

Section 1502.22 of the National Environmental Policy Act calls for agencies to disclose the unavailability of information in evaluating reasonably foreseeable significant adverse effects on the human environment. The absence of operational safety performance data for any component of the transportation system needed to move waste from generator sites to Yucca Mountain is a major gap in available information and should have been cited and discussed in the DEIS.

The DEIS describes some areas in which gaps in information exist, but it does not make those gaps clear. Sections of the DEIS where the gaps in information should be highlighted and implications of these gaps and the validity of conclusions of the DEIS should be thoroughly discussed.

In 1995, the DOE indicated in a report cited as a DEIS reference -- the report title is Nevada Potential Repository Preliminary Transportation Study 1. It indicated that input from the affected counties would be a consideration in selecting a route through Nevada to Yucca Mountain. Based on the concerns I've described above, Clark County believes that none of the implementing alternatives proposed in the DEIS are acceptable without further study.

Clark County contends that without detailed description of the packaging, handling, transportation and mitigation systems necessary to implement the Yucca Mountain transportation program, it's impossible to assess the impacts of this program.

Response
In this EIS, DOE has used computer models it has used in previous EISs and other studies. These models are widely accepted by the national and international scientific and regulatory communities. For instance, DOE selected the RADTRAN 5 computer program to estimate radiological impacts to populations from incident-free transportation and from accidents. RADTRAN, which was originally developed by Sandia National Laboratories in the late 1970s, has been used in many other previous DOE EISs, and it has undergone periodic review and revision. In 1995, an independent review of RADTRAN 4 (immediate predecessor to RADTRAN 5) demonstrated that it yielded acceptable results when compared to "hand" calculations. More recently, an independent review found that RADTRAN 5 overestimates the measured radiation dose to an individual from moving radiation sources.

To ensure that the EIS analyses reflect the latest reasonably available information, DOE has either incorporated information that has become available since the publication of the Draft EIS or modified existing information to accommodate conditions likely to be encountered over the life of the Proposed Action. For example, the analysis in the Draft EIS relies on population information from the 1990 Census. In this Final EIS, DOE has scaled impacts upward to reflect the relative state-by-state population growth to 2035, using 2000 Census data. The use of widely accepted analytical tools, latest reasonably available information, and cautious but reasonable assumptions if there are uncertainties, offer the most appropriate means to arrive at conservative estimates of transportation-related impacts.

DOE could ship spent nuclear fuel and high-level radioactive waste in several configurations, all of which would require a shipping cask designed to standards established by the Nuclear Regulatory Commission. There is substantial empirical data on the performance of shipping casks designed for the safe transport of spent nuclear fuel and high-level radioactive waste. In tests, casks have been rammed by high-speed trains, smashed into solid concrete structures, immersed in high-temperature fires, and submerged underwater. The results of these tests have confirmed that Type B casks can sustain severe transportation accidents while maintaining their safety functions. An analysis of the cask response to accident forces, referred to in the EIS as *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000), estimates that less than 0.01-percent of all accidents would generate forces that could lead to a release of radioactive material from a Type B shipping cask. Based on the evaluation in the EIS, no radiological impacts are projected for either the mostly legal-weight truck or mostly rail scenarios.

There were 60 accidents involving Type B packages between 1971 and 1997 (DIRS 102172-McClure and Fagan 1998). Of these, seven involved spent nuclear fuel. In each of these accidents the structural integrity of the cask remained intact and there was no release of radioactive contents. DOE would use legal-weight or heavy-haul trucks that met U.S. Department of Transportation requirements (49 CFR Parts 171 through 180).

DOE believes that the EIS provides the environmental impact information necessary to make certain broad transportation-related decisions, namely the choice of a national mode of transportation outside Nevada (mostly rail or mostly legal-weight truck), the choice among alternative transportation modes in Nevada (mostly rail, mostly legal-weight truck, or heavy-haul truck with use of an associated intermodal transfer station), and the choice among alternative rail corridors or heavy-haul truck routes with use of an associated intermodal transfer station in Nevada if the site was approved. However, follow-on implementing decisions, such as the selection of a specific rail alignment in a corridor, or the specific location of an intermodal transfer station in Nevada or the need to upgrade heavy-haul truck routes, would require additional field surveys, State and local government and Native American tribal consultations, environmental and engineering analyses, and the appropriate National Environmental Policy Act reviews.

8.8.1 (3114)
Comment - EIS000726 / 0008
The entire issue of calculated risk is a major concern. There is no mention of the degree of uncertainty associated with any of your calculated risk assessments. With no data to the contrary, I can only assume that the degrees of uncertainty are high.

The calculated risk must use accurate data and better estimates. It must include all risk factors, and must consider all known impacts to quality of life, the health of people and of the environment, and economic activity in the region.

Response
DOE is aware that there are uncertainties associated with the transportation impact results presented in the EIS. There are uncertainties associated with route characteristics, demographics, weather, atmospheric dispersion models, waste characteristics, accident rates, release fractions, and many other elements of the risk assessments. Because one of DOE's goals is to choose between alternatives, the consistent consideration of uncertainty among alternatives means that the relative differences in impact estimates among alternatives should not be affected. To account for uncertainties in the data, conservative assumptions were made so the impacts reported in the EIS would tend to overestimate the potential impacts. Examples of conservative assumptions include: accident release fractions which were selected from the high end of the distribution of experimental results, regulatory maximum radiation dose rates

were assumed for all shipments, even though the actual dose rates would be significantly lower for most shipments, consequences of severe accidents to maximally exposed individuals were presented for 50 percent and 95 percent (that is, consequences exceeded only 5 percent of the time) meteorological conditions, and evacuation and sheltering, which could reduce radiological exposures, were not included in the accident risk calculations. Although DOE has chosen to use conservative assumptions, the assumptions are not unrealistic to ensure that estimated impacts are as realistic as possible. Consistent with Council on Environmental Quality regulations (40 CFR 1502.22), DOE is attempting to avoid compounding conservatisms, yielding unrealistic results, in analyzing environmental impacts. Such practices mask the real differences and would not produce suitable results to support choices among the alternatives.

8.8.1 (3170)
Comment - EIS001194 / 0001
As an engineer, I was deeply troubled not so much by what was revealed in the fact sheets and policy briefs concerning the proposed transit route for commercial nuclear waste, but by what they surreptitiously attempted to obscure. Combing through this public relations hype, I was given over to the impression that legal jargon had been substituted for much more precise scientific notation. An example would be the suffix "person-rems," which appears in this literature. Were this term intended to indicate the approximate quantity of rems per total number of individuals within a contaminated perimeter, it would - when applied to a population center with a concentration as dense as that of Cleveland - denote a radiation hazard many times in excess of that which Hiroshima suffered in August of 1945. If instead the term is more properly interpreted as the average rem dosage to which any individual within a certain proximity might be exposed, the figure, while remaining unacceptably high, becomes indicative of a contamination level significantly less catastrophic than the aforementioned. I have a suspicion, however, that the term was coined to designate not quite one nor exactly the other.

Response
The radiological impact evaluation terms and techniques used in the EIS are consistent with the typical practices of the Environmental Protection Agency, the Nuclear Regulatory Commission, and DOE. These terms are explained in more detail in Section 3.1.8.1 of the EIS. The terms and their usage are also consistent with the practices set forth by the United States and international radiation protection organizations.

The term person-rem is used to convey the total collective radiation doses received by a population exposed to radioactive material. For example, the Latent Cancer Fatalities textbox in Section S.4.1.8 of the EIS Summary states, "…if each individual in a population of 100,000 received a total dose of 0.001 rem, the collective dose would be 100 person-rem…"

The 100 person-rem collective dose value is the product of the 100,000 persons and 0.001 rem received by each person. Alternatively, it can be viewed as the sum of the doses received by each person of a given population exposed to radiation.

8.8.1 (3253)
Comment - EIS000981 / 0001
Has the DOE conducted the necessary HAZARD ANALYSIS, VULNERABILITY ANALYSIS and RISK ASSESSMENT in the City of St. Louis for the rail and highway routes identified in the newspaper article? If so, can we obtain a copy of that assessment. If not, will the assessment be conducted and will the City of St. Louis receive a copy of the assessment and/or be a part of the assessment team?

Response
Although the EIS contains an assessment of national transportation impacts for shipping spent nuclear fuel and high-level radioactive waste to the proposed repository, location-specific assessments have not yet been performed. Highway routes would be selected in the future in accordance with the U.S. Department of Transportation regulations in 49 CFR Part 397. Rail routes would be selected to reduce time in transit, minimize number of railroad to railroad interchanges, and use high quality mainline track. Use of routes would be subject to review by the Nuclear Regulatory Commission under regulations in 10 CFR Part 73. However, it is premature at this time to analyze the hazards, vulnerabilities, and risks of specific routes and locations to identify preferred routes. The highway routes presented in the EIS are used for illustration purposes and to provide technically defensible route characteristics data to support the calculation of transportation impacts. In DOE's judgment, the routes used in the

EIS represent reasonable information available at this time and the use of other routes would not change the results of the transportation impact calculations substantially.

Should a decision to proceed with the development of a repository at Yucca Mountain be made, shipping routes would be identified at least 4 years before shipments began and Section 180(c) assistance would be made available approximately 4 years prior to shipments through a jurisdiction. See Section M.6 of the EIS for a discussion of the DOE Section 180(c) Policy and Procedures.

8.8.1 (3337)
Comment - EIS001121 / 0003
Putting aside the obvious dangers (accident, terrorists, etc.) I am disturbed by your prediction of 18 latent cancer fatalities by truck, and 5 latent fatalities by rail. I would like to know how you came up with these figures, without any of these CASKS having been built? I know that you test by scale but I can't believe that this would apply in this situation.

With these predictions in mind it tells me that you are anticipating a leakage in these CASKS. I would like to know who are these predicted fatalities? What is the risk to the drivers of these trucks?

Response
Section 6 and Appendix J of the EIS provide comprehensive information on the techniques and assumptions used in the analysis of worker and public health safety risks. Transportation of spent nuclear fuel and high-level radioactive waste is an integral part of the ultimate disposition of these wastes in a geologic repository and the EIS addresses the potential impacts associated with a transportation campaign (see Chapter 6 and Appendix J). In determining whether to recommend the Yucca Mountain site to the President, the Secretary of Energy will take transportation impacts into account. Section 6.2.3.1 indicates that there would be 2.5 latent cancer fatalities among members of the general public along routes from legal-weight truck transport of spent nuclear fuel and high-level radioactive waste for the 24-years of operation. DOE recognizes the potential for transportation accidents and analyzed impacts resulting from transportation accidents in Section 6.2.4. Although, given the number of shipments, traffic accidents would be probable, DOE does not believe that any accident would result in the release of radioactive material, primarily because of the structural integrity of the casks in which the material would be transported. In the more than 2,700 shipments involving spent nuclear fuel over the past 3 decades, there have been seven accidents, with no release of radioactive materials to the environment. Though an accident resulting in release of radioactive material is not expected to occur, the Department analyzed the maximum reasonably foreseeable accident would involve the release of material from a transportation cask. This would be an extremely unlikely event (an annual probability of 2.8 [rail] to 2.4 [truck] in 10 million). The leaking of a transportation cask could only occur if mechanical forces (impact) and heat (fire) exceeded the design limits of the transportation cask structures and materials. The EIS states that an accident involving the leaking of a transportation cask could result in approximately 5 latent cancer fatalities in an urban area under stable (slowly dispersing) atmospheric conditions. The air pathway is the most likely mode of exposure to radioactive materials though other pathways, including water and contaminated food sources are included. A severe accident in another population zone (for example, rural) or in other atmospheric conditions would have lower consequences.

Section M.4 of the EIS provides additional information on shipping cask design, safety, and testing. Shipping casks of various designs have been built and used for the shipment of spent nuclear fuel in the United States and worldwide. The Nuclear Regulatory Commission has certified several new cask designs in recent years and other designs are in the review process. These designs and current regulatory requirements are sufficient to provide the cask-related input parameters that DOE used to calculate incident-free radiation exposures. These include the external dose rate emitted from the shipping cask, which DOE assumed at the maximum limit allowed by U.S. Department of Transportation and Nuclear Regulatory Commission regulations, and the cargo capacity of the shipping casks that would determine the number of shipments required to transport spent nuclear fuel and high-level radioactive waste to the repository. With regard to the maximum allowable external radiation dose rate, actual shipments would be likely to emit lower dose rates, but could not emit a higher dose rate. DOE based shipping cask capacities on the certified casks and those in Nuclear Regulatory Commission review.

8.8.1 (3621)
Comment - EIS001101 / 0002
The DEIS is incomplete in that there is no description and analysis of the affected environment for each Nevada transportation route. National transportation routes for rail and highway shipments are not identified and analyzed. The EIS should include analyses of potential impacts and hazards of all alternatives in order to support a selection from among the alternatives.

Response
Complete descriptions of the affected environment can be found in Sections 3.2.2, 6.3.2, and 6.3.3 of the EIS for the heavy-haul truck and rail implementing scenarios, including descriptions and analyses of the impacts of highway and rail improvements, as well as construction and operation of intermodal transfer stations. Section J.3 provides descriptions of potential legal-weight truck, heavy-haul truck, and rail routes in Nevada. National transportation routes and associated environmental impacts are addressed in Section 6.2. In response to comments on the Draft EIS, DOE revised Appendix J to include state-by-state route maps, the numbers of shipments in each state, and state-specific health and safety impact estimates (see Section J.4). This is in addition to the route maps that were already included in the Draft EIS (see Section 2.1.3.2 for national routes and Section 2.1.3.3 for Nevada maps).

With respect to alternatives, in the Draft EIS and the Supplement to the Draft EIS, DOE analyzed a variety of scenarios that offer a range of options in which to implement the Proposed Action to construct, operate (including transportation) and monitor, and eventually close a repository at Yucca Mountain. These scenarios, which reflect potential repository design and operating modes, waste packaging approaches, and transportation options for shipping spent nuclear fuel and high-level radioactive waste to the Yucca Mountain site, bounded the environmental impacts likely to result from the Proposed Action. DOE conducted hearings to obtain public input on the scope of this EIS and has reviewed previous public comments on repository-related transportation alternatives (for example, comments on the Draft Environmental Assessments). As stated in Section J.3.1.2 of the EIS, one of the rail corridor alternatives analyzed in the EIS was identified on the basis of public comments submitted during scoping hearings.

DOE evaluated the potential environmental impacts from the transportation of spent nuclear fuel and high-level radioactive waste from 5 DOE and 72 commercial sites to a repository at Yucca Mountain. At this time, many years before shipments to a repository could begin, it is impossible to predict the exact number of shipments that would be made by either truck or rail. For this reason, in the Draft EIS, DOE evaluated two scenarios for moving the materials to Nevada:

- Transport using mostly legal-weight trucks
- Transport using mostly rail

In DOE's judgment, the EIS considers a reasonable range of scenarios that cover the full spectrum of transportation system alternatives, and bounds the potential environmental impacts associated with the transportation of spent nuclear fuel and high-level radioactive waste.

8.8.1 (3896)
Comment - EIS001286 / 0006
A recent study from the Texas Transportation Institute of traffic in Greater Cleveland and 67 other metropolitan areas found that traffic jams are getting more frequent and severe. In 1997, 50% of traffic was congested. Freeways are also more crowded. The number of miles traveled daily on freeways rose 66.5% from 1982 to 1997 (clipping enclosed). DOE must account for non-accident exposures that will become routine when casks are trapped in heavy traffic with other vehicles for long time periods.

Response
The estimated exposure of a person stuck in a traffic jam for 1 hour sitting 1.2 meters (4 feet) from a spent nuclear fuel cask is given in Section 6.2.3 of the EIS. Additional information on the potential transportation impacts is presented in Appendix J.

8.8.1 (4063)
Comment - EIS001181 / 0001
The potential environmental risk based on every aspect, from shipping loads cross country to unstable recommendations for radiation levels, are cause for reevaluation. I-15 in California, just one of many proposed routes, is one of California's most dangerous sections of highway, near the proposed site. Also the EPA [Environmental Protection Agency] has challenged the proposed limits for radiation exposure posed by the DOE.

Response
The highway routes for shipment of waste to the proposed repository at Yucca Mountain would be selected in accordance with U.S. Department of Transportation regulations in 49 CFR 397.101. Interstate-15 in California could be used because it is an Interstate System highway that could be part of one or more preferred routes that would reduce time in transit for shipments, and if so would meet requirements listed in the regulation. Radiation exposure limits during transportation are set by the Department of Transportation regulations in 49 CFR 173.441 and by the Nuclear Regulatory Commission in 10 CFR 71.47; they are not posed by DOE. The Environmental Protection Agency has not challenged these limits.

8.8.1 (4130)
Comment - EIS001473 / 0001
It is apparent that if Yucca Mountain is realized, and that's still a problem that has to be addressed, has to be technically established, the transportation will be a profound impact on the state of Utah.

Response
In response to public comments, DOE has included in Section J.4 of the EIS maps of the highway routes and rail lines it used for analysis. It also included potential health and safety impacts associated with shipments for each state through which shipments could pass.

8.8.1 (4205)
Comment - EIS001160 / 0027
The DEIS does not adequately address issues raised and substantiated by White Pine County during the scoping process. For example:

The analysis should evaluate the risk management benefits of time-of-day travel restrictions (i.e. to avoid transport past the White Pine County High School during school hours). The DEIS does not consider time-of-day travel restrictions as a risk management option.

Response
Section M.3 of the EIS describes DOE's acquisition process for Waste Acceptance and Transportation Services Contractors. This section also describes the protocols that would be used by DOE and the Regional Servicing Contractors for highway route determination for transporting spent nuclear fuel and high-level radioactive waste to the proposed repository. In addition to the requirements of the U.S. Department of Transportation for highway routing of highway route controlled quantities of radioactive materials, which would include spent nuclear fuel and high-level radioactive waste (49 CFR 397.101), the Regional Servicing Contractors should consider, among other things, preferred time of day travel through urban areas. However, alternate routes may be designated by the State of Nevada.

8.8.1 (4207)
Comment - EIS001160 / 0028
The DEIS does not adequately address issues raised and substantiated by White Pine County during the scoping process. For example:

The EIS should assess the regional economic benefits of using of local versus non-local trucking firms. The DEIS does not provide a comparative assessment of the regional economic benefits of using local v. non-local trucking concerns.

Response
DOE has developed a draft Request for Proposal for waste acceptance and transportation services (DIRS 153487-DOE 1998), as discussed in Section M.3 of the EIS. As outlined in this draft, each successful responder to the final request, called a Regional Servicing Contractor, would be responsible for all shipping arrangements and transportation services in its servicing region(s). DOE anticipates that it would invite national, regional, and local transportation companies to participate in the selection process for the contractor and potential subcontractors to provide specific services. DOE believes that it should defer an evaluation of the use of local versus nonlocal trucking firms to provide heavy-haul truck services to the contractor selection process or the selected contractors. Such an evaluation would not affect the comparison of alternatives or decisions DOE would make using the results presented in the EIS.

8.8.1 (4208)
Comment - EIS001160 / 0029
The DEIS does not adequately address issues raised and substantiated by White Pine County during the scoping process. For example:

The impacts of alternative vehicle payloads upon highway infrastructure, maintenance costs and traffic safety should also be addressed within the EIS. The DEIS does not appear to assess added maintenance costs or the change in crash rates per vehicle miles traveled as a result of slow-moving vehicles (i.e. heavy-haul trucks).

Response
The estimated costs shown in Section 6.3.3.2.1 of the EIS are based on detailed engineering estimates, which include lane widening, truck lane and turnout construction, pavement upgrades, intersection upgrades, and shoulder upgrades. The cost estimates developed for highway upgrades associated with candidate heavy-haul truck transport implementing alternatives include costs for annual maintenance of the roads that would be used. The impact estimates were based on engineering and cost studies documented in *Cost Estimate for Heavy Haul Truck Transportation* (DIRS 154675-Ahmer 1998), including detailed cost estimate for the design, construction, and management of the initial road upgrades for public roads for each of the five candidate heavy-haul truck transport routes.

As described in Section J.1.1.4.2 of the EIS, crash rates and accident severities used in the EIS accident analyses were not adjusted for lower speeds of heavy-haul trucks.

8.8.1 (4212)
Comment - EIS001160 / 0026
The DEIS does not adequately address issues raised and substantiated by White Pine County during the scoping process. For example:

Legal weight truck operational alternatives, which should be considered within the EIS, include escorted versus unescorted shipments. The DEIS does not consider the risk benefit/cost implications of escorted vs. unescorted shipments.

Response
In Section 2.1.3.2 of the EIS, DOE states that the transportation of spent nuclear fuel and high-level radioactive waste would be in accordance with U.S. Department of Transportation and Nuclear Regulatory Commission requirements and that all shipments would be monitored. Commission regulations for in-transit physical protection (10 CFR 73.37) require escorts for all spent nuclear fuel shipments. Within highly populated areas, the vehicle must be occupied by two individuals, one of whom serves as an escort. In addition, the vehicle must be escorted by an armed member of the local law enforcement agency in a separate vehicle. Another option is for the transport vehicle to be led and trailed by vehicles each occupied by at least one armed escort. A transport vehicle travelling through an area not considered highly populated must have as a minimum a driver and another individual who acts as an escort. Another option is for the vehicle to be occupied by a driver and escorted by a separate vehicle occupied by at least two escorts. Given these Commission requirements, unescorted shipments are not an alternative. Additional information on physical protection of spent nuclear fuel shipments is provided in Section M.7.

8.8.1 (4215)
Comment - EIS001160 / 0032
The DEIS does not adequately address issues raised and substantiated by White Pine County during the scoping process. For example:

The DEIS should consider those environmental features which may affect safe transport of radioactive materials. Examples include weather conditions, wildlife conflicts with vehicles, and flood prone areas, among other possibilities. The DEIS only considers these environmental features as such may be impacted by construction and operation of the transportation system. The extent to which these environmental characteristics may impact upon safe transportation is not addressed within the characteristics DEIS.

Response
While the EIS does not specifically evaluate scenarios such as those mentioned in this comment, the transportation accident statistics used in the assessment of nonradiological impacts include accidents where the environmental features described by the commenter are included. Adverse weather conditions and impacts with wildlife are frequently cited as causes or contributors to vehicular accidents. DOE would use a satellite tracking and communications system, such as the TRANSCOM system, for spent nuclear fuel and high-level radioactive waste shipments to provide truck crews and escorts with warnings of upcoming poor weather conditions, allowing the shipment to take an alternate route or proceed to a designated safe in-transit parking area to await better conditions. In addition, routine en route communications would provide warnings of pending floods that could affect a shipment. Accidents involving a vehicle and wildlife would not be a significant threat to release radioactive material from spent nuclear fuel and high-level radioactive waste shipments.

More detailed information on transportation planning and operations is provided in Section M.3 of the EIS.

8.8.1 (4282)
Comment - EIS001160 / 0089
Page 2-80: The third point on this page states, "Impacts from the transportation of spent nuclear fuel and high level radioactive waste from the commercial and DOE sites to the Yucca Mountain Site would be low for either national shipping mode." This statement is unsubstantiated in as much as the table it references is both unclear in its statistics and does not account for worst case scenarios. A better statement would be that statistical probability of impacts would be low, but actual impacts are not only unknown, but liable to random accident, man caused incidents and acts of nature. While these are addressed later in the study, they should at least be prefaced here.

Response
The impacts to the maximally exposed individuals listed in Table 2-7 would be, at worst, an incremental probability of 1 chance in 50 (0.02) of contracting a fatal cancer. This risk is for truck crews who are assumed to receive a maximum dose of 2 rem per year for 24 years. DOE expects these individuals would be subject to occupational exposure limits and their exposures would be monitored. The probability of a member of the public contracting a fatal cancer would be much smaller than that for the truck crew, as lis7ed in Table 2-8.

The consequences to the maximally exposed individual from maximum reasonably foreseeable transportation accidents would be low. This is based on a 1-in-about-70 chance (0.015) of contracting a fatal cancer following a maximum reasonably foreseeable rail accident. These are small probabilities in relation to the probability that an individual would contract a fatal cancer from all potential causes [22 percent or 0.22, according to the American Cancer Society (DIRS 101482-American Cancer Society 1998)], including carcinogens in the environment, natural background radiation, and all other radiation sources. Therefore, DOE believes the data in Table 2-7 are sufficient to support the conclusion that the transportation of spent nuclear fuel and high-level radioactive waste to the proposed repository would represent a low risk.

8.8.1 (4299)
Comment - EIS001160 / 0108
Page 6-31, Paragraph 3, Last Line of this page states, "The maximally exposed individual, assumed to be about 360 meters (I 180 feet) from the accident would receive a dose of about 3.9 rem (Table 6-1 1)." The assumption of the maximally expose individual at nearly 1200 feet is an unrealistic assumption. Where was this derived from? Is there a national standard that references that distance as a common reference? If an average lane, on an average

US Highway is 14 feet, and the average setback distance in any given municipality is about 50 feet, (I have no reference for this, but could probably produce one), then the maximally exposed individual might be an average (not including people who came in for closer a look) of 64 feet from the accident site. Assuming that the radiation dose is inversely proportional to the square of the distance from the source (Sourcebook on Atomic Energy, Glasstone 1979, pp 752 footnote) it is conceivable that a maximally exposed individual might receive perhaps 800 to 1000 rem. Even a brief exposure at this distance would most probably prove fatal. Extended exposures, (greater than an hour) would certainly prove fatal. The estimates of dose do not appear realistic and could be easily exceeded.

Response
As discussed in Appendix J of the EIS, the principle radiological exposure in a very severe transportation accident would be long term exposure to radioactive materials inhaled following release from a cask. Release of radioactive material from a cask would be unlikely in transportation accidents, occurring in only about 0.01-percent of accidents (DIRS 152476-Sprung et al. 2000). The small particles, gasses, and volatile radionuclides would be transported by the smoke and winds and deposited downwind from the accident. Direct exposure to gamma and neutron radiation penetrating the cask would only be the dominant exposure pathway if the shielding of the cask was heavily damaged in a so-called loss of shielding accident. The analysis in the EIS includes estimates of dose to a first responder to a rail accident where the involved cask has lost a portion of its radiation shield. The dose estimated for this first responder is 0.83 rem. This dose is smaller than the dose of 29 rem to a maximally exposed individual who would be 330 meters (1,100 feet) downwind from the accident and would be exposed to a passing cloud of radioactive particles, gasses, and volatile materials.

DOE evaluated doses to the maximally exposed individual from the maximum reasonably foreseeable accident for 50- and 95-percent atmospheric dispersion conditions (that is, consequences would not be exceeded 50 and 95 percent of the time, respectively). The atmospheric dispersion model used in the calculations accounted for several phenomena that would affect the timing and concentrations of released material as the plume dispersed. Some of these phenomena (such as plume rise from the thermal condition of the released material) would cause the concentrations of radioactive material in the plume to be higher at distances farther from the release point than they would be near the release. The model determined the distance at which the maximum concentration would occur, and calculated the consequences to an individual at that distance.

8.8.1 (4363)
Comment - EIS001157 / 0008
The transportation, assumptions must be reevaluated to reflect the transportation system development that is most likely to be in place during the transportation phase. This analysis should account for the effects of major construction activities on the shipments.

Response
The EIS reflects transportation system development in several ways. First, accidents that are caused by or have contributing factors related to highway construction are included in the state-specific accident rates used in the calculations. Second, the EIS performed an analysis that accounted for future construction of the Las Vegas Beltway (see Section J.3.1.1). Third, the EIS presents several alternatives for construction of rail corridors and heavy-haul truck routes, in addition to construction and operation of intermodal transfer stations. Fourth, population data is adjusted to account for projected population growth at the time the shipments are planned to take place. Based on this, DOE believes the EIS adequately accounts for known and projected future transportation system development. However, for purposes of estimating a conservative range of the likely impacts of transportation, the EIS does not attempt to speculate on potential improvements to the highway infrastructure and vehicles that could increase safety, such as intelligent vehicles, enhanced traffic monitoring and control, improved braking systems, improved tires, etc.

8.8.1 (4651)
Comment - EIS001462 / 0002
I agree with most of the statements except for one thing. The use of the linear no-threshold models predict health risks and deaths to the public, grossly exaggerates the risks inherent to storage and moving nuclear waste.

Response
Sections 6.1.1 and J.1.1 of the EIS provide the definitions of accident risk and dose risk used in the EIS impact analyses. DOE recognizes that, although studied extensively for over 75 years, there is still much that is not understood about the health effects of exposures to low level radiation. However, the Department is not aware of any substantial, peer-reviewed literature that indicates disproportionate harm associated with exposure to low-level radiation.

Because of uncertainties in the low-dose/dose-region of the dose effect curve, DOE has selected, for use in the EIS, dose-to-risk factors recommended by the National Council on Radiation Protection and Measurements (DIRS 101856-NCRP 1993) and the International Commission on Radiological Protection (DIRS 101836-ICRP 1991) for estimating the risk of latent cancer fatality from exposure to ionizing radiation. These factors were developed based on the linear no-threshold hypothesis, which assumes that adverse health effects could occur from exposure to ionizing radiation regardless of how small the dose.

DOE, as well as national and international scientific advisory organizations such as the Federal Radiation Council (FRC 1960), the International Commission on Radiation Protection (DIRS 147927-ICRP 1966), the National Council on Radiation Protection and Measurements (DIRS 101857-NCRP 1993), the National Academy of Sciences/National Research Council Committee on the Biological Effects of Ionizing Radiation [BEIR V] (DIRS 100473-National Research Council 1990), and the National Academy of Sciences/National Research Council Committee on an Assessment of CDC Radiation Studies (NRC 1995), have recognized for many years that the use of dose-to-risk conversion factors based on the linear no-threshold hypothesis to estimate stochastic effects (such as latent cancer fatalities) from very low exposures to ionizing radiation might overestimate the actual risk. These organizations have been careful to point out over the years that the use of the risk factors derived using the linear no-threshold hypothesis will provide reasonable assurance the actual effect would not be underestimated. For these reasons, the linear no-threshold hypothesis has been accepted for use by Federal agencies—including DOE, the U.S. Environmental Protection Agency, and the Nuclear Regulatory Commission—for radiation protection and for estimating risk from exposure to ionizing radiation. Until such time as these advisory committees change their acceptance of the linear no-threshold hypothesis and the Federal agencies agree that these changes should be incorporated, DOE will continue to use risk factors recommended by the national and international advisory groups that are based on the linear no-threshold hypothesis.

8.8.1 (4889)
Comment - EIS000337 / 0029
Page 6-24, Table 6-6. I want to know the exposure to a person with a baby who is next to a mostly legal-weight truck that is stopped next to her in a traffic jam where she is not more than 10 feet from the truck. This should be included in the Table 6-6.

Response
The actual exposure would be less than 0.02 rem indicated in the cited table. The exposure distance used in the assessment was 1.2 meters (4 feet), rather than the 3 meters (10 feet) suggested by the comment. The calculated doses are listed in Tables 6-9 (mostly legal-weight truck scenario) and 6-12 (mostly rail scenario). The exposure to a pregnant woman would be the same as the exposure to another individual the same distance from a shipment. Section J.1.3.2.2 of the EIS provides more details on the methods used to evaluate radiological doses to maximally exposed individuals.

8.8.1 (5145)
Comment - EIS001911 / 0004
An analysis of Yucca Mountain must include a complete analysis of transportation issues, including routes, transportation packages, and health and safety concerns.

Response
A complete analysis of transportation issues is presented in Chapter 6, Appendix J, and Appendix M of the EIS. Specifically addressed are issues such as routes, packages (casks), and health and safety.

8.8.1 (5192)
Comment - EIS001443 / 0017
Specific Recommendation: The DEIS should include results of a comprehensive national-scale risk analyses to determine least-risk based solutions to the question of which roadway and rail corridors to use to increase the predictability of waste transportation operations. The risk analysis should provide the quantitative information necessary to confirm or deny the value of each reasonable potential transportation scenario. Impacted populations and resources should be clearly identified in the DEIS. DOE should use the results of this analysis to systematically dictate routes to private carriers. The value of the Chalk Mountain Route for achieving major reductions in risk to civilian populations should be quantified and discussed. The specific assumptions used by the RADTRAN4 model should be discussed by the DEIS.

Response
Chapter 6 and Appendix J of the EIS present the results of a comprehensive national-scale risk analysis. This Final EIS expresses the DOE preference for the mostly rail as mode of transportation, both nationally and in Nevada. However, the purpose of the EIS is not to choose or identify national transportation routes, select a rail corridor, or dictate routes to private carriers. As discussed in Section M.3.2.1.2, carriers would follow U.S. Department of Transportation and Nuclear Regulatory Commission requirements in determining their routes. These routes would be part of the transportation plan that the carrier would prepare and that DOE would provide to states for comment. DOE and the Nuclear Regulatory Commission would approve the final routes.

DOE believes that the EIS adequately analyzes transportation-related impacts that could result from the Proposed Action. DOE also believes that the EIS provides the information necessary to make decisions on the basic approaches to transporting spent nuclear fuel and high-level radioactive waste (either rail or truck shipments), as well as the choice among alternative rail corridors in Nevada, if the site is approved. The introduction to Chapter 8 of this Comment-Response Document contains additional information.

The results of the transportation analyses described in Chapter 6 and Appendix J show that the impacts of using any of the candidate routes would be low. Appendix J summarizes the specific assumptions used in the RADTRAN computer code. The references cited in Appendix J provide more details.

8.8.1 (5289)
Comment - EIS001887 / 0035
The use of the all train scenario is especially problematic because, given the lack of rail access to Yucca Mountain, there is no justification for it. The Draft EIS, as discussed elsewhere in these comments, does not demonstrate that rail or intermodal (rail to heavy-haul truck) access to Yucca Mountain is feasible. Therefore, assuming that all spent fuel and HLW [high-level radioactive waste] can be shipped to the site via rail is inappropriate.

Response
The feasibility of constructing a branch rail line to the proposed repository was evaluated in *Nevada Potential Repository Preliminary Transportation Strategy* (DIRS 104795-CRWMS M&O 1995) and CRWMS M&O (DIRS 101214-1996). The results of these studies identified four candidate rail corridors deemed feasible based on AREA (American Railway Engineering Association) guidelines. An additional (fifth) corridor was added in 1997.

The two documents listed above evaluated and confirmed the feasibility of heavy-haul truck transportation in Nevada, based on current regulations, highway conditions, and Nevada Department of Transportation history associated with heavy-haul truck permitting.

8.8.1 (5291)
Comment - EIS000968 / 0008
A traffic safety study should be included.

Response
DOE interpreted this comment as a criticism of the scope of the transportation impact analysis in the EIS. The Department believes that the scope of the analysis is adequate. It based the development of the scope on current repository planning, reviews of past National Environmental Policy Act documentation related to the permanent disposal of spent nuclear fuel and high-level radioactive waste [for example, the *Nuclear Waste Policy Act*

(Section 112) Environmental Assessment, Yucca Mountain Site, Nevada Research and Development Area (DIRS 101314-DOE 1986)], and public scoping meetings. In 1995, DOE conducted 15 public scoping meetings across the U.S and solicited comments on the scope of this EIS, and used this information to shape the scope and analytical approaches used in the EIS.

DOE believes that the EIS provides the environmental impact information necessary to make certain broad transportation-related decisions, namely the choice of a national mode of transportation outside Nevada (mostly rail or mostly legal-weight truck), the choice among alternative transportation modes in Nevada (mostly rail, mostly legal-weight truck, or heavy-haul truck with use of an associated intermodal transfer station), and the choice among alternative rail corridors or heavy-haul truck routes with use of an associated intermodal transfer station in Nevada if the site was approved. However, follow-on implementing decisions, such as the selection of a specific rail alignment in a corridor, or the specific location of an intermodal transfer station in Nevada or the need to upgrade heavy-haul truck routes, would require additional field surveys, State and local government and Native American tribal consultations, environmental and engineering analyses, and appropriate National Environmental Policy Act reviews.

In general, traffic safety studies support detailed designs of new transportation infrastructure (highways, crossings, traffic signals, bridges, etc.), select specific routes, and provide useful insights to infrastructure alignment in a corridor.

8.8.1 (5374)
Comment - EIS001887 / 0091
Page 2-40; Section 2.1.3.2 - National Transportation

The analysis of national transportation impacts associated with the Proposed Action contained in the Draft EIS is both legally and substantively deficient. The Draft EIS presents an inappropriately generic analysis of impacts; fails to identify cross Country shipment modes and routes that would be necessary to implement the Proposed Action; ignores impacts to corridor cities and communities across the nation; misrepresents actual shipment volumes; underestimates the impacts of worse case accidents and terrorist/sabotage events; understates the potential health effects of routine, non-accident shipment operations; employs unrealistic shipping scenarios as the basis for analysis; ignores potentially significant and pervasive socioeconomic impacts associated with the massive and unprecedented shipping campaign required to move waste from generator locations to Yucca Mountain; and generally understates risks to health, safety, and the environment.

Response
The EIS analyzes the potential environmental and socioeconomic impacts that could occur, directly and indirectly, as a result of the construction, operation, and eventual closure of the monitored geologic repository at the Yucca Mountain site. Quantitative human health and safety impacts, as well as other environmental and socioeconomic impacts (for example, impacts on land use, water resources, biological resources, employment), for transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain are presented in Chapter 6 and Appendix J of the EIS. The transportation impact analysis in the EIS is consistent with the requirements of the National Environmental Policy Act, Council on Environmental Quality guidelines, and DOE policies and guidance.

The EIS was designed to provide the quantitative information necessary to support the decisions to be made based on the EIS. As stated in the Overview of the EIS Summary:

"DOE believes that the EIS provides the environmental impact information necessary to make certain broad transportation-related decisions, namely the choice of a national mode of transportation outside Nevada (mostly rail or mostly legal-weight truck), the choice among alternative transportation modes in Nevada (mostly rail, mostly legal-weight truck, or heavy-haul truck with use of an associated intermodal transfer station), and the choice among alternative rail corridors or heavy-haul truck routes with use of an associated intermodal transfer station in Nevada…Other transportation decisions, such as selection of a specific rail alignment within a corridor, would require additional field surveys, State and local government and Native American tribal consultations, environmental and engineering analyses, and appropriate National Environmental Policy Act reviews."

The commenter is correct in that the EIS does not present the impacts to specific people, specific communities, and specific elements of the environment along the national transportation routes, although this information is presented for the State of Nevada. The scope and level of detail for the transportation impact analysis is consistent with National Environmental Policy Act requirements, Council on Environmental Quality guidelines, and DOE policies and procedures.

The analysis is route- and location-specific to the extent needed to support the decisions to be made on the basis of the information contained in this EIS. Development and presentation of impacts to each potentially affected community along the transportation routes would not materially affect the comparisons of alternatives and decisions to be made with regard to construction and operation of the proposed repository. Transportation routing decisions would occur in the future, and would be conducted in accordance with U.S. Department of Transportation routing guidelines and Nuclear Regulatory Commission regulations governing safeguards and security for shipments of spent nuclear fuel.

Because the risks of the entire shipping campaign are small in relation to other risks commonly encountered and accepted by the public, DOE does not believe that nationwide, location-specific impacts for all highway and rail routes would provide any useful insights or beneficial information required to make the decisions to be made from this EIS. Potential impacts to the environment along these routes, such as impacts to water, biological resources, land use, etc., are not quantified in the EIS because no new land acquisition or construction is required to accommodate these shipments. Potential environmental impacts within Nevada are quantified because new construction will be needed to implement the rail and heavy-haul truck alternatives.

The analysis is route-specific to the extent needed to support the decisions to be made on the basis of the information contained in this EIS. Although some "generic" data is used, the analysis used route-specific population distributions, shipping distances, numbers of shipments, etc., and state-level information on accident rates. Special considerations are given to calculating the transportation impacts in Nevada. Nevertheless, in response to comments, DOE has provided in Appendix J of the EIS the detailed state-by-state maps of highway and rail routes used in the analysis in the EIS leading from generator sites to the Yucca Mountain site, the numbers of shipments on each route, and state-by-state impacts (see Section J.4).

DOE has used the best information that was reasonably available on spent nuclear fuel and high-level radioactive waste characteristics and quantities to evaluate transportation impacts (see Appendix A of the EIS). DOE has performed extensive evaluations to project shipping cask capacities that were used in the EIS to determine shipment volumes (see Section J.1.2). In addition, the transportation scenarios were constructed to bracket the total shipment volumes, which would be maximized for a near 100 percent mostly legal-weight truck scenario and minimized for a near 100 percent mostly rail scenario. Transport mode selection is further explained in Section M.3 and in the Request for Proposals for Waste Acceptance and Transportation Services (DIRS 153487-DOE 1998) and located at *http://www.rw.doe.gov/wasteaccept/wasteaccept.htm*.

The National Environmental Policy Act requires assessment of reasonably foreseeable impacts from proposed agency actions. In its various EISs, DOE has defined a reasonably foreseeable accident as one that has a frequency of occurrence of at least once in 10 million years (1×10^{-7} per year). The concept of a maximum reasonable foreseeable accident is sometimes misinterpreted as being a "worst-case" accident.

While the character of the spent nuclear fuel shipments for the project could appear to present opportunity for sabotage, DOE believes these shipments would not be attractive targets in that they would not provide the opportunity for a large number of fatalities or a symbolic blow against a symbol of the nation. DOE also believes that a shipment of spent nuclear fuel or high-level radioactive waste would be an unlikely target in part due to the physical security measures imposed by the Nuclear Regulatory Commission regulations. Under certain conditions, armed escorts would either follow or ride in the truck cab or an escort railcar. DOE would monitor its spent nuclear fuel and high-level radioactive waste shipments through a satellite-based tracking system.

For the Final EIS, DOE reexamined, for both rail and truck casks, the consequences of an attack that results in a release of material (in other words, the cask's shield wall is penetrated) (see Section 6.2.4.2.3 of the EIS), and estimated consequences exceeded those presented in the Draft EIS. Differences in the consequences between the Draft EIS and the Final EIS are due to using "representative" spent nuclear fuel isotopics (as opposed to "typical" in

the Draft EIS) and an escalation of impacts to represent population growth to 2035. In addition, in the Draft EIS, the consequences of the sabotage event were bounded by those of the maximum reasonably foreseeable accident. However, the Final EIS analyses estimated that a sabotage event could cause 48 latent cancer fatalities if a legal-weight truck cask was penetrated and 9 latent cancer fatalities for a rail cask.

DOE is aware that there are uncertainties associated with the transportation impact results presented in the EIS. There are uncertainties associated with route characteristics, demographics, weather, atmospheric dispersion models, spent nuclear fuel characteristics, accident rates, release fractions, and many other elements of the risk assessments. Because one of DOE's goals is to choose between alternatives, the consistent consideration of uncertainty among alternatives means that the relative differences in impact estimates among alternatives should not be affected. To account for uncertainties in the data, conservative assumptions were made so the impacts reported in the EIS considers the range of associated potential impacts (that is, they would produce results higher than the true risk). However, DOE has chosen not to use assumptions that would result in overestimation of impacts in all cases, as this practice tends to produce unrealistic and improbable results. Consistent with Council on Environmental Quality regulations (40 CFR 1502.22), DOE is attempting to avoid compounding conservatisms, yielding unrealistic results, in analyzing environmental impacts. Such practices mask the real differences and would not produce suitable results to support choices among the alternatives.

The EIS presents potential environmental and socioeconomic impacts that could occur, directly or indirectly, as a result of the proposed siting, construction, operation, and eventual closure of a monitored geologic repository at Yucca Mountain, including transportation activities. The scope and level of detail of the socioeconomic impact analysis is consistent with the National Environmental Policy Act, Council on Environmental Quality guidelines, and DOE policies and guidance.

In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews calculations of land area contaminated and costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments, and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $9.4 billion. Cost data used in the studies reviewed in Section J.1.4.2.5 included data compiled from case studies involving actual cleanup of radioactive materials contamination. The studies address consequences for releases of radioactive materials in communities.

Should Yucca Mountain be selected as the site for the monitored geologic repository, DOE would continue to provide clear, accurate information to the public regarding the potential risks of a repository at the site and of transporting waste to the site so members of the public could understand the level of risk that actually existed (rather than perceived) associated with construction, operation, and closure of the Yucca Mountain Repository and related transportation activities.

8.8.1 (5449)
Comment - EIS001887 / 0138
Page 2-79; Section 2.4.4.1 - National Transportation

The summary of national transportation impacts is based on inadequate and incomplete data and analyses and does not reflect the impacts posed by the Proposed Action to people, communities, and the environment along national shipping routes. Since specific routes are never identified, analyses of impacts to at-risk communities are never attempted in the Draft EIS. No effort is made to identify and evaluate the potential for substantial socioeconomic impacts in corridor states and communities (see comments relative to Sections 4, 5, and 6 below). The use of fatalities (either latent cancer fatalities (LCFs) or accident fatalities) as the measure of transportation impacts is inadequate and serves to grossly understate the full range of negative impacts on people and the environment associated with the Proposed Action. As noted in subsequent comments, the models and assumptions used to generate LCFs, transportation accident rates, and accident probabilities and severity are deficient and understate the consequences of a national shipping campaign of the size, complexity, and duration needed to implement the Proposed Action. In addition, entire categories of potential impacts (such as socioeconomic impacts, morbidity, quality of life, etc.) are simply ignored.

Response

The commenter is correct in that the EIS does not present the impacts to specific people, specific communities, and specific elements of the environment along the national transportation routes, although this information is presented for the State of Nevada. The scope and level of detail for the transportation impact analysis is consistent with National Environmental Policy Act requirements, Council on Environmental Quality guidelines, and DOE policies and procedures. However, in response to comments, DOE has revised Appendix J of the EIS to include the state maps showing routes used in the analyses in the EIS, estimated numbers of shipments in each state, and the impacts in each state (see Section J.4).

The transportation impact analysis in the EIS was designed to provide the quantitative information necessary to support the decisions to be made in the EIS. As stated in the Overview to the EIS Summary:

"DOE believes that the EIS provides the environmental impact information necessary to make certain broad transportation-related decisions, namely the choice of a national mode of transportation outside Nevada (mostly rail or mostly legal-weight truck), the choice among alternative transportation modes in Nevada (mostly rail, mostly legal-weight truck, or heavy-haul truck with use of an associated intermodal transfer station), and the choice among alternative rail corridors or heavy-haul truck routes with use of an associated intermodal transfer station in Nevada…Other transportation decisions, such as selection of a specific rail alignment within a corridor, would require additional field surveys, State and local government and Native American tribal consultations, environmental and engineering analyses, and appropriate National Environmental Policy Act reviews."

The analysis is route- and location-specific to the extent needed to support the decisions to be made on the basis of the information contained in this EIS. DOE does not intend to designate routes based on the EIS. Rather, this would occur in the future, in accordance with U.S. Department of Transportation routing guidelines. The routes would be submitted to the Nuclear Regulatory Commission for approval.

Potential impacts to the environment along the routes, such as impacts to water, biological resources, land use, etc., are not quantified in the EIS because no new land acquisition or construction is required to accommodate these shipments (see Section 3.2.1 of the EIS). Potential environmental impacts within Nevada are quantified because new construction would be needed to implement the Nevada rail and heavy-haul truck implementing alternatives.

Throughout the EIS, the standard unit for measure of human health impacts is the risk of fatality. This approach was adopted for both radiological hazards and nonradiological hazards (for example, traffic accidents) to simplify the presentation of human health impacts and to facilitate the comparison of impacts among the alternatives. "Fatality" is an easily understood objective measure used historically in EISs prepared by DOE.

In light of the comments received on the Draft EIS concerning perceived risk, DOE examined relevant studies and literature on perceived risk and stigmatization of communities to determine whether the state-of-the-science in predicting future behavior based on perceptions had advanced sufficiently since scoping to allow DOE to quantify the impact of public risk perception on economic development or property values in potentially affected communities (see Section 2.5.4 and Appendix N of the EIS). Of particular interest were those scientific and social studies carried out in the past few years that directly relate to either Yucca Mountain or to DOE actions such as the transportation of foreign research reactor spent nuclear fuel. DOE reevaluated the conclusions of previous literature reviews such as those conducted by the Nuclear Waste Technical Review Board and the State of Nevada, among others. DOE has concluded that:

- While in some instances risk perceptions could result in adverse impacts on portions of a local economy, there are no reliable methods whereby such impacts could be predicted with any degree of certainty
- Much of the uncertainty is irreducible, and
- Based on a qualitative analysis, adverse impacts from perceptions of risk would be unlikely or relatively small.

While stigmatization of southern Nevada can be envisioned under some scenarios, it is not inevitable or numerically predictable. Any such stigmatization would likely be an aftereffect of unpredictable future events, such as accidents,

which would not be expected to occur. As a consequence, DOE addressed but did not attempt to quantify any potential for impacts from risk perceptions or stigma in this Final EIS.

8.8.1 (5889)
Comment - EIS001901 / 0003
California citizens have not had an opportunity to comment on the substance of the section on transportation of the draft EIS (DEIS). An example of the flaws in the DEIS is the method used by DOE to calculate the extent of a dust cloud. They used the average wind speed for the entire United States and the average model for the entire United States. This type of analysis reduces the impact of the local winds and atmospheric conditions found in California.

Response
As discussed in Section J.1.4.2.1, the EIS uses atmospheric conditions that are generally applicable throughout the contiguous United States because it is not possible to predict specific locations for accidents. These data were used to determine the most likely atmospheric conditions to prevail during a severe accident or act of sabotage. Two meteorological conditions were included in the assessment of the consequences of the maximum reasonably foreseeable accident. These included neutral or stable conditions, in which the consequences would not exceed 50 percent of time, in addition to stable conditions in which the consequences would be exceeded only 5 percent of the time. This was done to ensure that no accident scenarios that are otherwise credible would be excluded from the assessment of the maximum reasonably foreseeable accident because of a low probability of encountering stable atmospheric conditions. In other words, the already low frequency of occurrence of a severe transportation accident, when multiplied by the probability of stable atmospheric conditions, could have caused the accident scenario frequency to drop below the $1x10^{-7}$ per year cutoff that defines the frequency of the maximum reasonably foreseeable accident. Thus, the EIS attempts to ensure that maximum reasonable accident scenarios are not eliminated from the assessment in the EIS because of a low probability of specific weather conditions.

8.8.1 (5949)
Comment - EIS001622 / 0051
The DEIS lacks a complete and accurate project description. There is no description of transportation of radionuclide waste through California, no environmental consequences evaluation, and no mitigation offered. The DEIS should disclose the potential level of shipments through California, and evaluate potential impacts. In particular, transportation routes could potentially impact habitat for the Amargosa nitrophila, Nitrophila mohavensis, Amargosa vole, Microtus californicus scirpensis, State and Federal Endangered, and desert tortoise, Gopherus agassizii, State and Federal Threatened. The DEIS should include a description of transportation routes, improvements, impacts to these species as well as other State Species of Special Concern, and proposed mitigation measures to offset these impacts.

Response
The transportation impact analysis in the EIS was designed to satisfy the requirements of the National Environmental Policy Act, Council on Environmental Quality guidelines, and DOE policies and guidance. It was also designed to provide the information necessary to support the decisions to be made in the EIS. Lists of the threatened and endangered species, sensitive species, game habitat, springs, and riparian areas known to occur within 5 kilometers (3 miles) of rail corridors have been added to Appendix J of the EIS and those resources have been described more fully in Section 3.2.2.1.4. Sections 6.3.2.1 and 6.3.2.2 have been modified to better describe the impacts to biological resources within 5 kilometers of corridors.

Potential impacts to the environment along the national transportation routes, such as impacts to water, biological resources, land use, etc., are not quantified in the EIS because no new land acquisition or construction is required to accommodate these shipments (see Section 3.2.1 of the EIS). As a result, the EIS focuses on potential impacts to human health and safety along these routes. An environmental baseline characterization of every shipment corridor would not be practical nor would the information be needed to support the decisions to be made from this EIS. In response to comments on the Draft EIS, DOE revised Appendix J to include state route maps, the numbers of shipments in each state, and state-specific health and safety impact estimates, including data for California (see J.4). This is in addition to the route maps that were already included in the Draft EIS (see Section 2.1.3.2 for national routes and Section 2.1.3.3 for Nevada maps).

With regard to evaluating the impacts on specific species, the EIS follows the National Environmental Policy Act and the Council on Environmental Quality guidance on evaluating potential impacts to biota. Basically, plants and animals are no more sensitive to radiation than humans. Both acute and chronic radiation doses that do not adversely affect humans are not known to affect terrestrial species of plants and animals. The *Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards* (DIRS 103277-IAEA 1992) reports that there is no convincing evidence that indicates that the current radiological dose standards for humans will harm animal or plant populations. In other words, if humans are adequately protected, plants and animals are likely to be adequately protected.

Additional site-specific information would be necessary prior to construction of a branch rail line or road upgrades to support heavy-haul truck shipping. However (and as stated in the Overview in the EIS Summary), DOE believes that the EIS provides sufficient information on impacts (such as those to biological resources) necessary to make cetrtain decisions regarding the basic approaches (for example, mostly rail or mostly truck shipments) as well as the choice among alternative transportation corridors. Follow-on implementing decisions, such as selection of a specific rail alignment within a corridor, would require additional field surveys, state, local, and tribal government consultations, environmental and engineering analyses, and appropriate National Environmental Policy Act reviews.

Chapter 9 of the EIS provides DOE's initial list of commitments available at this time, identifies DOE-determined impact reduction features, procedures and safeguards, and mitigation measures under consideration for inclusion in the project plan and design. Chapter 9 also identifies ongoing studies that could eventually influence mitigation measures related to the project plan and design.

As indicated in Chapter 6 of the EIS, more detailed field surveys, government consultation, analyses, and appropriate National Environmental Policy Act reviews would be prepared if a decision was made to select a specific rail alignment within a corridor or a specific location of an intermodal transfer station or the need to upgrade the associated heavy-haul truck routes. This would include consultations with State wildlife management agencies, the Bureau of Land Management, the Army Corps of Engineers, and other applicable government agencies. Besides field surveys, this would include (as applicable) more detailed assessments and analyses of wetlands and other waters; floodplains; sensitive species; effects of habitat fragmentation, interruption of movements, mortality, and harassment on wildlife, horses, and burrows; loss of hunter-generated revenue, spread of noxious weeds, and soils.

8.8.1 (5991)
Comment - EIS001879 / 0017
The Draft EIS assumes that the typical spent fuel assembly has been enriched to less than 3.7 percent and has been stored on site at least 25 years after discharge from a nuclear reactor (pg. A-14). However, waste acceptance criteria permit shipment of more highly enriched, more highly irradiated and much younger (more radioactive) fuel to be shipped to Yucca Mountain. Nye County believes that a revised EIS should examine the effects of shipment of more highly radioactive material. Furthermore, the EIS should consider mitigating policies by which such fuel would be shipped only in sealed canisters that would not be unsealed for either storage or emplacement.

Response
The EIS now analyzes impacts of shipping younger, hotter fuel to the proposed repository at Yucca Mountain. It is true that DOE could ship some spent nuclear fuel that is more radioactive than the 26 year-old pressurized water reactor spent nuclear fuel analyzed in the Draft EIS scenario. Based on comments received and DOE's additional review of technical documents and conduct of hazard analyses, the basis for the transportation impact analysis has been revised to consider commercial spent nuclear fuel that has median hazard. Pressurized water reactor spent nuclear fuel having median hazard would be discharged from a reactor approximately 15 years before shipment to Yucca Mountain. The radionuclide inventories of the representative spent nuclear fuel used in the analysis are presented in Tables A-9 and A-10 of the EIS.

Fuel would be shipped either as uncanistered assemblies or in a sealed canister. The sealed canisters currently (January 2001) certified by the Nuclear Regulatory Commission can be used for storage and transport, but not for ultimate disposal. Therefore, the canisters would need to be unsealed at the repository and the fuel transferred to a waste package. If multipurpose (storage, transport, disposal) canisters were certified by the Commission, DOE would utilize them for disposal.

8.8.1 (6021)
Comment - EIS001679 / 0001
Railway in US is predominately privately owned. There is currently no responsibility of the Dept of Transportation to regulate Americas railways. DOE has relied only on CALTRANS to report on the safety of the railway in California. I submit to you that the DOE does not have adequate information regarding the safety of the rails and whether they are capable of safely carrying this dangerous material. Before moving forward I request that DOE commission an independent study on the safety of rails that are supposed to be used. Accident records and worker safety and staffing. The railways in Calif. are not being studied by anyone. How can you move forward without this valuable information?

Response
The U.S. Department of Transportation is the regulatory agency responsible for establishing and enforcing the standards for rail transportation. The Federal Railroad Administration, which is a branch of the U.S. Department of Transportation, is responsible for safety of the rail system, including track, locomotives, highway crossings, incident reporting, brake systems, etc. The Federal Railroad Administration regulations are provided in 49 CFR Parts 200 to 266.

Adequate rail lines, crossings, bridges, and tunnels exist to support the transportation of materials described in the EIS. The shipment of radioactive materials requires no special transportation infrastructure that is not necessary for safe transport of commodities in the United States today.

8.8.1 (6040)
Comment - EIS001580 / 0006
We believe they [DOE] have misrepresented the radiologic risk by using older, cooler, less radioactive fuel as their waste. We believe they've grossly underestimated routine radiation exposures, particularly at the end of the transportation funnel in Nevada. We believe they've significantly underestimated both the human health consequences and the economic costs of severe accidents, which they acknowledge could release significant amounts of radioactive materials.

Response
The EIS has been revised to use 15-year old, 50,000 megawatt-days per metric ton of heavy metal burnup spent nuclear fuel in the analysis of transportation risk. The EIS has also been revised to estimate impacts based on populations projected for 2035.

A discussion on the costs of cleanup has been added to the EIS. According to the Nuclear Regulatory Commission report *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152456-Sprung et al. 2000), in 99.99 percent of accidents involving transportation of spent nuclear fuel there would be no release of radioactive material from the cask. The economic costs of these accidents would be small.

In 0.01 percent of accidents some radioactive material could be released from the cask. Based on the studies discussed in Appendix J of the EIS, the economic costs of severe transportation accident involving spent nuclear fuel could be in the range of as little as $200,000 to $270 billion. However, extreme cost estimates are for accidents where all factors are assumed to combine in the most detrimental way to maximize consequences. Such extreme, or worst-case, accidents are not reasonably foreseeable so the estimates of cost are not useful for comparisons. The probability of the accidents analyzed in the studies range from about 1 in 1 million per year to less than one in 1 trillion (1 followed by 11 zeros) per year.

The current insured limit of responsibility for an accident involving releases of radioactive materials to the environment is $9.43 billion. Section M.8 of the EIS provides additional information on accident liability.

8.8.1 (6050)
Comment - EIS001580 / 0010
DOE has significantly overestimated the extent to which this waste can be moved by rail. They are optimistic and think they can move 90 percent of it by rail. We've looked at the same information site by site. We think they will only be able to move 50 to 60 percent by rail. The result is there will be many tens of thousands of truck shipments occurring at the same time that there are about ten thousand rail shipments.

Response
Page 6-1 of the Draft EIS clearly states the assumptions used to estimate the impacts of transportation. The mostly rail scenario assumes all waste generator sites with the capability to handle a heavy rail cask would ship by rail. The mostly legal-weight truck scenario assumes all waste except Navy fuel would be shipped by truck. These two scenarios represent the associated range of the possible combinations of rail and truck shipments.

DOE believes that the mostly rail case, in which more than 95 percent of spent nuclear fuel and high-level radioactive waste would be shipped by rail, would most closely approximate the actual mix of truck and rail shipments. In reaching this conclusion, DOE considered the capabilities of the sites to handle larger (rail) casks, the distances to suitable railheads, and historic experience in actual shipments of nuclear fuel, waste or other large reactor-related components. DOE also considered relevant information published by sources such as the Nuclear Energy Institute and the State of Nevada. In addition, DOE has identified mostly rail as its preferred mode of transportation, both nationally and in Nevada.

Nonetheless, in response to comments, DOE has analyzed the effects of different mixes of rail and truck shipments. The results of this analysis confirm DOE's estimate that the mostly rail and mostly legal-weight truck scenarios represent a reasonable range (lower and upper bound) of potential environmental impacts from the transportation of spent nuclear fuel and high-level radioactive waste.

8.8.1 (6152)
Comment - EIS001654 / 0033
The potential for transportation of the waste to "affect workers and the public through exposure to radiation and vehicle emissions, and through traffic accidents" is listed as an unavoidable adverse impact. There is substantial and adequate detailed information and analysis on that potential in Chapter 6. While there are less vehicle emissions and traffic accident impacts in the No Action Alternatives, the radiological impacts are substantially less under the Proposed Action than by leaving the waste at the 77 sites for 10,000 years under either scenario.

Response
Section 7.2.1.7.3 of the EIS discusses the radiological impacts of the No-Action Alternative. Table 2-7 in the EIS compares the estimated impacts of the Proposed Action and the No-Action Alternative. The table demonstrates that the total life-cycle health impacts of the Proposed Action are smaller than those of the No-Action Alternative even though the No-Action Alternative does not include impacts from transporting spent nuclear fuel and high-level radioactive waste to the repository.

8.8.1 (6326)
Comment - EIS001609 / 0002
During the Q and A session I asked several questions about transport. One of the questions I asked was regarding the assessment, regarding the environmental impact based on transport, you know, what traffic flow models were used. And the answer that I got, were no traffic flow models were used. The exposure, the risk was based on exposure per cask by number of casks, not taking into account traffic flow whatsoever. I think that's a little weird.

Response
The radiological impact modeling presented in Section J.1.3 of the EIS of the included the effects of reduced traffic flow, including the impact on an individual stuck in traffic. In addition, Section J.1.3 provides the average transporter speeds for rural and urban travel.

The estimated exposure of a person stuck in a traffic jam for 1 hour sitting 1.2 meters (4 feet) from a spent nuclear fuel cask is given in Section 6.2.3 of the EIS.

8.8.1 (6502)
Comment - EIS001632 / 0037
Impact on ground water from transport spills. The draft EIS assesses the impact of spills on surface water, but the final EIS should also assess ground water contamination from a surface spill. The transportation impacts analysis should consider ground water recharge zones and the proximity of transportation corridors to ground water supplies and community water systems.

Response
DOE does not specifically analyze a transportation accident, such as a spill, involving contamination of surface water or groundwater because the casks are designed to be water tight and spent-nuclear fuel and high-level radioactive waste are not easily dispersed in water. While small particles could be generated by the impact forces of an accident, and driven out of a shipping cask by a severe fire, the amount of contamination that might ultimately enter groundwater would be much lower than that which would initially enter surface waters. Factors such as soil sorption of radionuclides, rate of flow into recharge areas, dilution by rain water and surface water, dilution by the large volume of ground water, and delay associated with infiltration would mitigate and greatly reduce any contamination that might occur. Although DOE's analyses in Chapter 6 take into account the proximity of surface waters and ground water basins (see Section 6.3.2.2.1 of the EIS as an example), water pathway contamination, including subsequent contamination of food and natural resources, would not be a significant contributor to the radiological risks of transporting spent-nuclear fuel. Analyses performed in previous EISs (see Section 1.5.3 and Table 1-1) have consistently shown that the airborne pathway has the greatest potential for exposing large numbers of people to radioactive material in the event of transportation accident resulting in the release of radioactive materials. DOE has, however, identified potential mitigation measures for surface water and groundwater from the construction and operation of transportation systems. The reader is referred to Sections 9.3.3.1 and 9.3.3.2.

While DOE believes the information presented in these sections of the EIS are sufficient to assess the relative merits of the alternatives, the Department acknowledges additional environmental reviews would be required to assess the potential impacts of such things as specific alignments through a transportation corridor.

8.8.1 (6511)
Comment - EIS001241 / 0014
Does low-level radiological exposure decrease proportionally as rail speed increases?

Does low-level radiological exposure increase proportionally as rail speed decreases.

Would nuclear waste rail cars travel slower in densely populated?

Response
Radiation doses to individuals and populations in areas shipments pass through are inversely proportional to the speed of the transport vehicle through the area. In other words, radiological exposures decrease as speed increases, and increase as speed decreases. See the RADTRAN 4: Volume 3, User Guide (DIRS 101888-Neuhauser and Kanipe 1992) for additional information on the formulae used to calculate incident-free exposures from a moving shipment.

Trains travel slower in densely populated areas than in rural areas. Section J.1.3.2.1 of the EIS provides the shipment speeds used in the transportation impact analysis. As shown, the shipment speed in urban areas is slower than that in suburban areas, which are in turn slower than the speed in rural areas.

8.8.1 (6569)
Comment - EIS001632 / 0057
Page 6-20, third bullet: The term "dose risk" is not a standard term. What does it mean when used in the phrase, "to estimate radiological dose risk to populations"?

Response
DOE defined "dose risk" in a text box in Section 6.1.1 of the EIS as follows:

"Dose risk is the sum of the products of the probabilities (dimensionless) and the consequences (person-rem) of all potential transportation accidents."

8.8.1 (6634)
Comment - EIS001878 / 0027
Impacts of transportation alternatives pre-judged. Before the DEIS even describes the proposed action, the environment that would be affected, or the anticipated environmental impacts, it concludes that "environmental impacts do not appear to be a major factor in the selection of transportation mode, route, or corridor in Nevada for

incoming rail shipments." (p. 2-81) Such a conclusion is inappropriate under the description of the proposed action and no-action alternative and, in any event, is unsupported by any evidence and therefore conclusory. The DEIS acknowledges that there are differences in environmental impacts for the 10 implementing alternatives for rail shipments in Nevada.

Response
The statement referred to by the commenter appeared in Section 2.4 of the Draft EIS. Under 10 CFR 1502.14, the recommended format for preparing an EIS is to provide such a summary of findings along with the description of alternatives for the proposed action. As the title of Section 2.4 indicates, this section is a summary of information and impact estimates that appear elsewhere in the document that provide the supporting evidence for DOE's conclusions. The EIS fully describes the Proposed Action for Nevada transportation in Section 2.1.3.3, the environment that would be affected in Section 3.2.2, and the impacts of Nevada transportation in Section 6.3. The commenter is correct in that the EIS acknowledges that there are differences in environmental impacts between the 10 implementing alternatives for rail shipments in Nevada. However, the EIS states that these differences would be small, with the exception of land-use and environmental impacts for each of the 10 implementing alternatives (Section 2.4.4.2).

8.8.1 (6638)
Comment - EIS001160 / 0088
Page 2-80, Table 2-8: This table is unclear to the reader in that it doesn't define time parameter being measured. Does the table imply that the Maximally exposed individual receives 48 rem per year; over the course of all shipments; and so on? Units of measure should be defined over what time period, number of individuals exposed (i.e. collective dose stats) or in percentages based on shipments. The DEIS lacks sufficient information to allow the reader to deduce from either the table or appendices how these figures were arrived at. A maximally exposed individual receiving 48 rem per year (about 10 times maximum allowed under U.S. Federal Radiation Counsel Guidelines and 24 times the maximum accepted as safe practice by DOE) would have significant health risks. Even if this individual was exposed over the course of 10 years, his latent cancer probability should, on the basis of the logic in the DEIS, be about 10 times what the table predicts. The table itself should reference the appendices and how this data was developed and how those figures were arrived at, including related references.

Response
The commenter is correct in that Table 2-8 in the Draft EIS (Table 2-9 in the Final EIS) did not clearly identify the time period over which the exposure occurs. The actual estimate is based on the entire period of transportation operations supporting the repository. Thus the 48 rem calculated for the maximally exposed worker would be the dose received over 24 years and is appropriately expressed in units of rem. This dose is a conservative upper limit dose to a maximally exposed individual worker and is based on a maximum annual dose of 2 rem for a worker at a DOE facility permitted under current DOE radiological safety guidance (2 rem for 24 years equals 48 rem). Section 6.2.3.1 of the EIS discusses the basis for this estimate. The table was clarified in the Final EIS.

8.8.1 (6855)
Comment - EIS001466 / 0003
I want to talk a little bit about the shipments, because there were speakers who said, this is perfectly safe, we're very confident that there's not going to be any problem; and I just want to talk about what these things represent, because that was something that I found amazing at the Yucca Mountain project information center in Las Vegas.

I went through the whole place looking for a definition of radioactivity or what its significance is, and the closest thing I found was a place where it was talking about the radioactive particles, and there was one sentence that said "radiation can cause changes in human tissue." And that was the closest thing to an admission that there might be health effects associated with radioactivity in the whole Yucca Mountain project information center.

Response
Appendix F of the EIS provides a primer that explains the nature of radiation and toxic materials, radiation sources in the environment, radiation effects on human health, and toxic material effects on human health

The EIS contains numerous statements that operation of the proposed repository and associated transportation of spent nuclear fuel and high-level radioactive waste could result in health effects. For example, Section 6.1.1 of the

EIS states that an estimated 2.5 latent cancer fatalities could occur in the general population along transportation routes from radiation exposures resulting from the 24-year campaign of incident-free transport of spent nuclear fuel or high-level radioactive waste.

8.8.1 (7009)
Comment - EIS000402 / 0005
The equipment used, the trucks, trains, caskets, barrels and roads are they 100 percent safe. Has the weather and other environmental factors been taken into account? Would you allow your family to be nearby as the waste is transported?

Response
Although DOE expects that accidents would occur during the transportation of spent nuclear fuel and high-level radioactive waste, families would not be subjected to undue risks from the transportation of spent nuclear fuel and high-level radioactive waste to the proposed repository. To ensure the safe transportation of these materials, DOE would use shipping casks built to the rigorous design standards for Type B containers established by the Nuclear Regulatory Commission (see 10 CFR Part 71). Type B containers are designed and built to retain their radioactive contents in both normal and accident conditions. In addition, there is substantial empirical data on the performance of shipping casks designed for the safe transport of spent nuclear fuel and high-level radioactive waste. In tests, casks have been rammed by high-speed trains, smashed into solid concrete structures, immersed in high-temperature fires, and submerged underwater. The results of these tests have confirmed that Type B casks can sustain severe transportation accidents while maintaining their safety functions. An analysis of the cask response to accident forces, referred to in the EIS as *Reexamination of Spent Fuel Shipment Risk Estimates* (Sprung et al. 2000), estimates that less than 0.01 percent of all accidents would generate forces that could lead to a release of radioactive material from a Type B shipping cask. Based on the evaluation in the EIS, no radiological impacts are projected for either the mostly legal-weight truck or mostly rail scenarios.

Weather and other environmental factors might contribute to the occurrence of accidents. Weather-related accidents are included in the state-specific accident rates use in the EIS to calculate the impacts of transportation accidents and are thus taken into account in the EIS.

DOE is confident that the transportation of spent nuclear fuel and high-level radioactive waste can be conducted in a safe and environmentally acceptable manner. The doses to maximally exposed individuals from routine (incident-free) transport, as well as the impacts from maximum reasonably foreseeable accidents, would not result in any radiation-induced prompt fatalities or latent cancer fatalities.

8.8.1 (7066)
Comment - EIS001337 / 0022
The County [Lincoln] and City [Caliente] recommended that the DEIS consider operational alternatives including escorted versus unescorted shipments; time of day travel restrictions versus unrestricted transport; and use of local versus non-local trucking firms. The first two were suggested for consideration for their contribution to risk management. The third option set was recommended for evaluation to determine regional economic benefits. The DEIS does not consider operational alternatives for legal weight trucks as recommended by the County and City during scoping.

Response
All legal-weight truck transport would have to meet the requirements of 10 CFR Part 73 for physical protection (including escorts) for shipment of regulated quantities of irradiated reactor fuel. Highway routes would be selected in accordance with U.S. Department of Transportation regulations (49 CFR 397.101) for transporting highway route controlled quantities of radioactive materials. States or tribes may designate alternative preferred routes under 49 CFR 397.103. Additional information on regulatory requirements, security requirements, and proposed operational protocols for spent nuclear fuel and high level radioactive waste transportation to Yucca Mountain have been added to the EIS in Appendix M.

Appendix M of the EIS summarizes the draft request for proposal for waste acceptance and transportation services (DIRS 153487-DOE 1998).

8.8.1 (7157)
Comment - EIS001337 / 0053
The County [Lincoln] and City [Caliente] and comments to the scope of the EIS pointed out that risks associated with transportation of radioactive wastes through the County and City have been an important topic of local inquiry. The City and County pointed to research they sponsored which was performed by the University of Nevada, Las Vegas Transportation Research Center to evaluate the risks of transporting waste by highway and by rail through the area.* The study did conclude that the total accident risk (person rem) in the County for rail and highway transport was significantly greater than that estimated for other like areas around the United States. Total risk associated with rail and highway waste transport in rural areas of the County was also found to be significantly than that estimated for other like areas across the United States. In their comments, the County and City noted that although absolute levels of risk may be considered low, this study clearly indicates that residents of Lincoln County may be exposed to significantly greater levels of risk. The County and City urged DOE to recognize that the repository EIS must consider these differences as a means to ascertain viable options for reducing risk to levels commensurate with other regions of the United States. The DEIS does not provide a comparative assessment of transportation risks through Nevada, or more importantly Lincoln County and other regions of the United States. As a consequence important differences between levels of risk are not revealed. Within Nevada, the DEIS does demonstrate that risks of transporting waste through rural areas is riskier than through urban areas. However, the DEIS does not provide sufficient identification and evaluation of measure to mitigate greater risk levels in rural areas.

*Sathisan, Shasi et. al., Risk Analysis for Spent Nuclear Fuel Transportation Through Lincoln County Volume I: Rail Shipments, Volume IIA: Highway Shipments, Volume IIB: Technical Appendix, Transportation Research Center, Howard Hughes College of Engineering, University of Nevada, Las Vegas, February 1995.

Response
More than 9,000 rail shipments would pass through Caliente and Lincoln County over 24 years under the national mostly rail scenario. In addition, Caliente is under consideration as the location of an intermodal transfer station and is the starting point for several rail corridor and heavy-haul truck implementing alternatives. However, no shipments would pass through Caliente or Lincoln County under the mostly legal-weight truck scenario. The impacts from incident-free transportation and accidents would be low for either national transportation scenario (see Section 2.4.4.1 of the EIS). Therefore, the EIS demonstrates that the transportation of spent nuclear fuel and high-level radioactive waste would pose no undue risk to individuals or populations, either in Nevada or nationally.

DOE has not performed a comparative risk assessment of transportation through Caliente and Lincoln County with other areas of the country. The results of such an assessment are not necessary to support the comparison of alternatives and decisions to be made in the EIS. However, the Final EIS includes state-specific impacts, so this information is available on a state-by-state basis.

With regard to risk reduction and mitigation, DOE is committed to protecting human and environmental health as its first priority. Transportation of spent nuclear fuel and high-level radioactive waste would be conducted and risks would be managed in accordance with Federal regulations. These regulations are established to protect human health and safety. However, DOE will consider the costs and benefits of additional protective measures as it conducts more detailed transportation planning and studies to support the proposed repository. Section 9.3 of the EIS discusses potential measures under consideration to mitigate the impacts of transporting spent nuclear fuel and high-level radioactive waste to the proposed repository. Section M.3 presents information about DOE's current planning for transportation of spent nuclear fuel and high-level radioactive waste.

8.8.1 (7209)
Comment - EIS001337 / 0088
Pages 3-1 and 3-2 The listing of topics included in the description of the affected environment is not consistent with the topics assessed in the environmental consequence section. For example, under socioeconomic, housing and community services were considered as affected environment. In the environmental consequences section for Nevada transportation no estimates of the consequences to housing and community services is provided. This implies that the analysis of environmental consequences is incomplete in that it has not considered all aspects of the affected environment.

Response
Legal-weight truck shipments in Nevada would use existing highways. Because no new land acquisition or construction would be required, this EIS focuses on potential impacts to human health and safety and the potential for accidents involving legal-weight trucks.

For development of branch rail lines and heavy-haul truck capabilities, including an intermodal transfer station, Sections 6.3.2 and 6.3.3 of the EIS have been modified to discuss impacts to the various aspects of the potentially affected environment, including housing and community services.

8.8.1 (7459)
Comment - EIS001912 / 0034
Pg. 2-81 First Bullet states, "Environmental Impacts for each of the 10 implementing alternatives will be small." How can DOE make this statement when site-specific analysis for each route has not been completed?

Response
In Section 2.4 of the EIS, DOE summarizes that environmental impacts for each of the 10 implementing alternatives for shipments coming into Nevada by rail would be small. DOE bases this conclusion upon analysis of the existing information available for analysis; a full description of the proposed action for Nevada Transportation is found in Section 2.1.3.3; a full description of the environment that would be affected is described in Section 3.2.2; and the impacts of Nevada Transportation are more fully described in Section 6.3.

Based on the results of the impact analyses presented in Chapter 6 and Appendix J of the EIS, as well as the results published in numerous other studies and environmental impact analyses cited in the EIS, DOE is confident that spent nuclear fuel and high-level radioactive waste can be and would be safely transported to Yucca Mountain. DOE believes, as the EIS reports, that the potential impacts of this transportation would be so low for individuals who live and work along the routes that these individual impacts would not be discernible even if the corresponding doses could be measured. The analysis presented in the EIS factored in the characteristics of spent nuclear fuel and high-level radioactive waste, the integrity of shipping casks that would be used in transport, and the regulatory and programmatic controls that would be imposed on shipping operations (see Appendix M of the EIS). The EIS analytical results are supported by numerous technical and scientific studies that have been compiled through decades of research and development by DOE and other Federal agencies of the United States, including the Nuclear Regulatory Commission and the U.S. Department of Transportation, as well as by the international community, including the International Atomic Energy Agency.

8.8.1 (7643)
Comment - EIS001912 / 0101
Modules 1 and 2 nearly double the amount of waste shipped to Yucca Mountain-but no additional latent cancer fatalities. Please explain how this can occur. Wouldn't it be reasonable to assume additional latent cancer fatalities would occur with an increase in shipments?

Response
The number of latent cancer fatalities from transportation does increase with the amount of waste shipped to the Repository. Section 6.2 of the EIS presents summaries of the impacts of transporting spent nuclear fuel and high-level radioactive waste for the Proposed Action. Section 8.4 presents the impacts of transportation for the Inventory Modules. The impacts presented in Section 8.4 are greater than those listed in Chapter 6.

8.8.1 (7655)
Comment - EIS001928 / 0012
Pg. S-53-3rd para. – There is some confusion on what constitutes a rail shipment. It is stated that the "…mostly rail scenario would involve approximately 13,400 cask shipments (10,800 rail shipments and 2,500 legal-weight truck shipments)". If it takes 10,800 rail shipments to transport 10,800 casks, then obviously, the load is only one cask per train. Surely, rail transport will be more efficient that that. Please clarify.

Response
Because DOE cannot predict the exact number of rail casks that would be transported in each train, it assumed conditions that would represent the upper range of the impacts of transportation. In completing its analysis, DOE

assumed that each rail cask would be shipped on a single railcar. Accident rates were used for general freight transport on a railcar-per-mile basis. This accident rate information is independent of the number of railcars containing casks that are transported in a single train. The analysis thus assumed that 10,800 shipments of rail casks would be made by 10,800 railcars, so all probable accident occurrences could be considered within the range of possible consequences.

8.8.1 (7671)
Comment - EIS000817 / 0016
Your EIS makes all the same mistakes NRC [Nuclear Regulatory Commission] made in certifying so called "generic" cask designs. You think you can create a scenario on paper that bounds all "generic" analysis of transportation so you don't look at specifics. You don't even know if rail or truck will be the priority mode. You don't even really consider the no action alternative as reasonable for implementation. You need to analyze impacts to specific national transportation routes based on available information and compare transport to leaving it in the states that created the waste.

Response
It is impossible for DOE to specify the exact mode of transportation for all shipments or the exact routes that would be used years before shipments would be made. However, even though DOE prefers that most shipments be made using rail, it should be recognized that some truck shipments would be required. This is why the EIS analyzes both truck and rail as modes of transportation.

The EIS compares the impacts of the Proposed Action and the No-Action Alternative. Section 2-4 of the EIS summarizes this comparison.

Because the specific casks that would be used for truck and rail shipments of spent nuclear fuel and high-level radioactive waste have not been designated, the EIS addresses the performance of generic cask designs in estimating transportation impacts. The important factors needed for this impact assessment are cask performance under normal and accident transport conditions and cask capacity. Any cask used by DOE would have to be certified by the Nuclear Regulatory Commission.

The transportation analysis presented in the EIS is not a generic analysis of transportation impacts. For example, the number of shipments is based on site-specific estimates of spent nuclear fuel discharges, not generic estimates. The analysis of transportation impacts was based on specific routes using route-specific population densities and distances, and state-specific information such as accident rates.

8.8.1 (7948)
Comment - EIS001903 / 0012
The list of bullet items on page J-39 and/or the discussion on pages J-40 and J-41 regarding the "second kind of information" and the third kind of information" should be clarified. For example, the first full paragraph on page J-41 states, "The third kind of information--the distances individuals live from the route used in the analysis--is the estimated the [sic] number of people who live within 800 meter…of the route." Is the "third kind of information" distances? If so, this information is not explicitly used in RADTRAN4, which assumes uniform population density within a 1-mile corridor. Or is the "third kind of information" population density? If so, How does this differ from the "second kind of information"?

Response
In response to comments, the transportation analyses in Appendix J of the EIS have been substantially revised to improve readability. The third kind of information – the distances individuals live from the route used in the analysis – is the distance from the transportation route that people live within the 800-meter (0.5-mile) corridor. This information is used to define the population density distribution inputted into RADTRAN5. The EIS has been changed to correct this error.

8.8.1 (8059)
Comment - EIS000391 / 0016
Mineral County wants it put on record that a "health assessment" (at the cost of DOE) should be done now of all the affected counties. This assessment would reflect what is out there now. By showing the present health situations

now, a case may be made for not adding to a potential number of latent cancer fatalities, and for documenting current health conditions prior to a radioactive waste accident.

Response
The EIS provides information on the radiation environment in the Yucca Mountain region in Section 3.1.8.2 and health-related mineral issues in Section 3.1.8.3. Additional information on the current conditions in the environment in the Yucca Mountain region can be found in the *Environmental Baseline File for Human Health*) (DIRS 104544-CRWMS M&O 1999). The region of influence for which data has been collected consists of land within 80 kilometers (50 miles) of the proposed repository site. Mineral County falls outside the region of influence for the proposed repository site. Mineral County is, however, within 80 kilometers of candidate transportation corridors to Yucca Mountain. However, it would not be practical to conduct a "health assessment" of all potentially affected transportation routes between the waste generator sites and the proposed repository.

8.8.1 (8139)
Comment - EIS001653 / 0084
Pg. 6-22 It does not appear that DOE considered the greater waste volume scenario in its transportation analysis, why? This should be part of the proposed action.

Response
Sections 8.4, J.3.4, and J.3.5 of the EIS quantify the transportation impacts of the greater waste volume scenarios, referred to in the EIS as Inventory Modules 1 and 2.

8.8.1 (8171)
Comment - EIS001653 / 0100
[Chapter 8] Modules 1 and 2 nearly double the amount of waste shipped to Yucca Mountain-but no additional latent cancer fatalities. Please explain how this can occur. Wouldn't it be reasonable to assume additional latent cancer fatalities would occur with an increase in shipments?

Response
The number of latent cancer fatalities from transportation does increase with the amount of waste shipped to the Repository. Section 6.2 of the EIS presents summaries of the impacts of transporting spent nuclear fuel and high-level radioactive waste for the Proposed Action. Section 8.4 presents the impacts of transportation for the Inventory Modules. The impacts presented in Section 8.4 are greater than those listed in Chapter 6.

8.8.1 (8218)
Comment - EIS001021 / 0006
I am concerned in general about the lack of DOE's solicitation of input from the academic medical community on medical safety issues regarding the overall Yucca Mountain plan. In particular, I worry about the potential adverse health effects on people who must load, unload and move the high-level radioactive waste across the country, and I worry especially about the people who inhabit the towns and cities like St. Louis, Missouri and Belleville and East St. Louis, Illinois, where the railroads pass and derailments are well known and common occurrences. We need a lot more information on nuclear transport accidents that have occurred in the 2,500 "successful" shipments of similar high-level radioactive wastes that I have read have already taken place in the U.S. Where can I get this information?

Response
Potential adverse health effects to cask handling personnel, truck and rail crews, and the general public are quantified in Chapter 6 and Appendix J of the EIS. A discussion of the basis for the health effects estimates from exposures to radioactive materials and toxic chemicals is provided in Appendix F. Information on past accidents that occurred in the transportation of all radioactive materials, including spent nuclear fuel, are available from several sources, as discussed in Section J.1.4.2.3.1.

Transportation by legal-weight truck would involve shipments along Interstate System highways in accordance with U.S. Department of Transportation regulations (49 CFR 397.101). These regulations limit shipments to Interstate System highways and require shippers to use Interstate System beltways and bypasses where available. DOE recognizes that even an incident-free transportation campaign could adversely affect people who live or work near

transportation routes. Section 6.2.3.1 of the EIS indicates that there would be 2.5 latent cancer fatalities from legal-weight truck transport of spent nuclear fuel and high-level radioactive waste for the 24-years of operation. DOE also recognizes the potential for transportation accidents and analyzed impacts resulting from transportation accidents in Section 6.2.4. Although, given the number of shipments, traffic accidents would be probable, DOE does not believe that any accident would result in the release of radioactive material, primarily because of the structural integrity of the casks in which the material would be transported. In the more than 2,700 shipments involving spent nuclear fuel over the past 3 decades, there have been seven accidents, with no release of radioactive materials to the environment.

The EIS states that approximately four traffic fatalities could occur in the course of transporting high-level radioactive waste and spent nuclear fuel under the mostly legal-weight truck scenario during the 24 years of operation and 350 million kilometers (220 million miles) of highway travel. In the mostly rail scenario, there could be approximately 3 traffic and train accident fatalities. Though an accident resulting in release of radioactive material would be unlikely, DOE analyzed the maximum reasonably foreseeable accident that would involve the release of material from a transportation cask. This would be an extremely unlikely event (an annual probability of 2.8 [rail] to 2.4 [truck] in 10 million). A leaking transportation cask could only occur if mechanical forces (impact) and heat (fire) exceeded the design limits of the transportation cask structures and materials. The EIS states that in an accident involving a leaking transportation cask could result in approximately 5 latent cancer fatalities in an urban area under stable (slowly dispersing) atmospheric conditions. The air pathway is the most likely mode of exposure to radioactive materials, although the analysis included other pathways, including water and contaminated food sources. A severe accident in another population zone (for example, rural) or in other atmospheric conditions would have lower consequences.

8.8.1 (8288)
Comment - EIS000817 / 0105
P. 4-86. I frankly think that basing your analysis on some old Navy representative site from 5 manufacturers at that time probably isn't very valid. Manufacture of containers is just coming into its "heyday" with lots of new designs up for NRC [Nuclear Regulatory Commission] generic certification. Who are these 5 facilities you base your analysis on? Just what do they actually make? ("Components" are not "casks.")

Response
Section 4.1.15.1 of the EIS describes the overall approach and analytical methods used for the environmental evaluation of the baseline data from the *Department of Navy Final Environmental Impact Statement for a Container System for the Management of Naval Spent Nuclear Fuel* (DIRS 101941-USN 1996). As pointed out, cask designers have submitted designs to the Nuclear Regulatory Commission for a number of transportation casks. Manufacture of casks following issue of certificates of compliance by the Commission could be accomplished by several qualified manufacturers. For this reason and to provide information for use in the analysis, five sites, having existing buildings and equipment needed to manufacture cask components, were used to provide a representation of cask manufacturing sites. The representative sites used are located in Westminster, Massachusetts; Greensboro, North Carolina; Akron, Ohio; York, Pennsylvania; and Chattanooga, Tennessee. It is common for cask manufacturing companies to purchase certain cask components rather than manufacture the entire cask in-house. As such, impact analysis in the EIS conservatively assumed that all manufacturing would occur at a single site to overemphasize potential impacts.

8.8.1 (8376)
Comment - EIS001873 / 0061
P. 6-24 & 26. The DEIS should state in which community the "maximally exposed" resident will live and on which section of the route the worker will work.

Response
Information on how radiological impacts to workers and members of the general public from incident-free transportation and severe accidents were evaluated are explained in Chapter 6 and Appendix J of the EIS. Individuals modeled are hypothetical members of the workforce supporting transportation activities and members of the general public at a specified distance from the shipment or other transportation activity. As detailed in the EIS, specific transportation modes and routes have not yet been determined. At this time, many years before shipments could begin, it is impossible to predict accurately which highway routes or rail lines DOE could use for all

shipments that would be made. Before such shipments began, states or tribes may designate alternate preferred highway shipping routes, and highways and rail lines could be built or modified. Therefore, it is not possible to identify in which community the maximally exposed resident live or on what section of the route the maximally exposed worker would work.

8.8.1 (8470)
Comment - EIS000817 / 0142
P. 6-20. Unloading storage casks and loading transport casks will be a big concern at beginning and end of transport route. Fuel handling repeatedly will have an effect on the assemblies and they must be checked. Can you predict these effects? I don't think so. Loading operations are not "routine" and unloading has not been done!! And transportation cask testing needs to be redone. Sabotage event evaluation needs to be redone. The world has changed a lot -- these need updating as to road and rail hazards and new weapons available.

Response
The impacts of loading spent nuclear fuel and high-level radioactive waste into transportation casks at 72 nuclear powerplants and 5 DOE sites are evaluated in Section 6.2.2 of the EIS. The impacts of unloading operations at the proposed repository are evaluated in Section 4.1.7.3.

Significant experience in both wet (that is, underwater) and dry (that is, within heavily shielded enclosures) handling of spent nuclear fuel, including loading and unloading storage and transportation casks has been accumulated in the United States and Europe. This experience has been applied to the design and operation of cask and fuel handling systems. This experience confirms that handling operations can be conducted safely without undue risk to the public and workers and without causing significant damage to spent nuclear fuel assemblies.

The NWPA requires that DOE use casks certified by the Nuclear Regulatory Commission when transporting spent nuclear fuel and high-level radioactive waste to a repository. The Commission certifies that a cask meets the requirements of 10 CFR Part 71, which prescribes radiological performance standards for casks subjected to specific test conditions. These test conditions represent the kinds of forces that a cask would encounter in a severe transportation accident. A cask's ability to survive the tests prescribed by 10 CFR Part 71 can be demonstrated in several ways. These options include component, scale-model, and full-scale tests to demonstrate or confirm the performance of the casks. As part of its detailed technical review, the Commission decides what level of physical testing or analysis is appropriate and necessary for each cask design. If the applicant for a certificate fails to demonstrate compliance with the regulations, the Nuclear Regulatory Commission would not issue a certificate. Therefore, if full-scale testing was necessary, it would be done before the Commission issues a certificate of compliance. For a more complete discussion of cask testing, see Section M.4 of the EIS. DOE has the option of evaluating the need for a full-scale cask test demonstration in the future.

The Nuclear Regulatory Commission is currently considering in the Package Performance Study (DIRS 155571-Best 1999), which is an update of the *Shipping Container Response to Severe Highway and Railway Accident Conditions* (DIRS 101828-Fischer et al. 1987; also called the Modal Study) used in the EIS, a request to conduct full-scale testing of a present generation cask to demonstrate the validity of computer models used in cask design and certification activities. DOE will evaluate the results of the Package Performance Study when it is published.

The impacts of acts of sabotage on spent nuclear fuel shipping casks are evaluated in Section 6.2.4.2.3 of the EIS.

8.8.1 (8603)
Comment - EIS001837 / 0007
You heard on Tuesday, 2/22/00 at the hearing in San Bernardino, our California Governor's office, the State Departments and the County have found the Yucca Mt. DEIS document to be inadequate and deficient. The document is so deficient that it needs to be redrafted and recirculated.

Clearly, a rewrite is needed to address alternative routes that should have been included in the DEIS, for example, there are no alternate routes proposed for the area between Barstow and parts east. If the railroad line is closed down for some reason in the Needles area, what will be done with the shipment. Will roads be used? If so, alternate routes must be assessed. The routes through Nevada are no longer considered alternatives due to pressure from

people in Nevada. So they forced a single funnel through Needles and left Needles totally out of the hearings. This is unacceptable and a clear case of environmental injustice.

Response
National transportation routes and associated environmental impacts are addressed in Section 6.2 of the EIS. Section 6.2.3 analyzed the impacts of transporting spent nuclear fuel and high-level radioactive waste using two scenarios: mostly legal-weight truck and mostly rail. The routes selected for the analyses met U.S. Department of Transportation regulations (49 CFR 397.101) and conformed to normal routing railroad practices. While these might not be the routes used in the future because of infrastructure changes or other variables, they are representative and therefore the analyses provide sufficient information on which to make decisions. In response to comments on the Draft EIS, DOE revised Appendix J to include state route maps, the numbers of shipments in each state, and state-specific health and safety impact estimates, including data for California (see Section J.4). This is in addition to the route maps that were already included in the Draft EIS (see Section 2.1.3.2 for national routes and Section 2.1.3.3 for Nevada maps).

Because there are not very many rail routes to choose from in the Southern California area, there is no reasonable route between Barstow and parts east. The maps available on the Yucca Mountain Internet site (*http://www.ymp.gov*) and in Appendix J of the EIS do not show any rail routes through Needles. However, if a railroad line was closed down anywhere, shipments would be stopped and protected until the line was opened.

8.8.1 (8647)
Comment - EIS001889 / 0002
The DEIS fails to consider the impacts of legal-weight truck transportation through White Pine County, and even goes on to demonstrate (Table J-78) that the risks of transporting SNF and HLRW through the County are significantly greater than risks associated with current routes used to transport low level radioactive waste (LLWR). This could possibly warrant significant cumulative impacts.

Response
Section J.3.1.3 of the EIS presents a sensitivity analysis to assess the affect on the impacts in Nevada of use of candidate alternative highway routes for legal-weight trucks. This analysis includes one route that would travel through White Pine County and provides estimates of impacts for Nevada if this route was used. The impacts are greatest for this route principally because it is the longest route. None of the transportation implementing alternatives analyzed by DOE in the EIS involves White Pine County. Under the mostly rail scenario, no shipments would travel through White Pine County, so there would be no impacts. In addition, unless the State of Nevada designated a preferred route that passed through the County no truck shipments would pass through White Pine County on the way to the proposed repository so there would be no impacts. None of the rail or heavy-haul truck implementing alternatives travels through White Pine County. Therefore, it can be concluded that no transportation impacts would occur in White Pine County under any implementing alternatives analyzed in the EIS. However, should the State of Nevada submit alternate routes to DOT and these routes meet DOT requirements, these routes could be used by DOE.

8.8.1 (8657)
Comment - EIS001837 / 0023
PARD demands to know exactly how many REMs are being emitted from the casks and what the effect of the exposure would be upon people working at the downtown Needles depot and to the people living on California Avenue and Front Street. The change over at the Needles depot is likely to be long, with security personnel, engineers, and conductors switching and with fueling.

Response
U.S. Department of Transportation regulations [49 CFR 173.441(b)] limit the amount of radiation that a cask can emit to 10 millirem per hour at a distance of 2 meters (6.6 feet) from the side of the transport vehicle. The dose rate at 30 meters (98 feet) would be less than 0.2 millirem per hour. In reality, the measured dose rates from actual shipments would probably be lower than the maximum allowable under current limits but would not be higher. Nevertheless, DOE used the maximum allowable dose rate to calculate exposures to the public along routes, which included people living or working within 0.8 kilometer (0.5 mile) on each side of the route. In addition, the analysis determined collective doses to the public while a shipment was stopped in railyards along the route. The EIS

analyzed impacts to maximally exposed individuals such as rail crew members, inspectors, and railyard workers. Section J.1.3.2 describes these analyses, and Section 6.2.3.2 contains their results.

8.8.1 (8717)
Comment - EIS002119 / 0005
About half of the -- about half of the document is devoted to transportation, to impacts related to transportation. There is little consideration of the feasibility of transportation plans. For example, there was no -- there's no thought it seems of what effect heavy-haul operations would have through rugged terrain on insufficient infrastructure through congested urban areas on insufficiency analyzed routes in conflict with present planned land uses. We would imagine that even a minor incident would lead to -- to congestion not even seen during the worst of commute hours.

Response
DOE has taken into consideration the impacts of heavy-haul truck transportation and they are discussed in Section 6.3.3.1 of the EIS and the subsequent subsections that address the specific impacts of heavy-haul truck implementing alternatives (routes), including land use and ownership and socioeconomics, including current urban and transportation plans. Since proposed heavy-haul truck routes are on existing highways that could require upgrades (see Section J.3.1.2), the analysis found no current conflicts with existing or planned land use. Some of the measures that could lessen these potential impacts are outlined in Section 2.1.3.3.3.2, which discusses the proposed road upgrades to accommodate heavy-haul truck traffic.

Operating policies and protocols that would be implemented for the transportation program are those required by the U.S. Department of Transportation, the Nuclear Regulatory Commission, and the Department, as outlined in the request for proposal for Regional Servicing Contractors and summarized in Section M.3 of the EIS. These protocols address routing procedures through rugged terrain and during severe weather and road conditions. The impacts analyzed in the EIS include impacts of traveling through urban areas including slow speeds, congested traffic and sharp turns (DIRS 154675-Ahmer 1998).

DOE believes that the EIS provides the environmental impact information necessary to make certain broad transportation-related decisions, namely the choice of a national mode of transportation outside Nevada (mostly rail or mostly legal-weight truck), the choice among alternative transportation modes in Nevada (mostly rail, mostly legal-weight truck, or heavy-haul truck with use of an associated intermodal transfer station), and the choice among alternative rail corridors or heavy-haul truck routes with use of an associated intermodal transfer station in Nevada. DOE has identified mostly rail as its preferred mode of transportation, both nationally and in Nevada. At this time, however, the Department has not identified a preference among the five candidate rail corridors in Nevada.

8.8.1 (8786)
Comment - EIS001907 / 0021
Nuclear power plants are required to have a 50 mile radius emergency planning zone. How come the DEIS only looks at a half mile radius of these transportation routes?

Response
Emergency planning zones for nuclear powerplants in the United States are actually much smaller, with a typical radius of about 16 kilometers (10 miles). Radiological impacts of accidents, however, are typically calculated out to about 80 kilometers (50 miles), because that is the extent to which most particulates would be dispersed from near ground-level releases. This is the typical practice of Nuclear Regulatory Commission, Environmental Protection Agency, and DOE analyses. This EIS used techniques consistent with accident analyses conducted at nuclear powerplants and analyzes the impacts from transportation accidents out to 80 kilometers. Radiological impacts of incident-free transport were calculated out to 800 meters (0.5 mile) from the road or branch rail line. This is because the radiation dose rate emitted by the shipping casks would be vanishingly small and individual and population exposures would be essentially zero beyond this distance.

8.8.1 (8946)
Comment - EIS001922 / 0010
The DEIS grossly underestimates the transportation risks from the unprecedented 53,000 truck shipments (estimated) of nuclear waste over 24 years of operation. Containers have not yet been constructed or tested.

Therefore realistic estimates of radiation leakage or container performance in an accident are not possible. The DOE's assumption that accidents will not occur is entirely unreasonable. In sum, EPA's [Environmental Protection Agency's] analysis of transportation impacts is entirely unreliable and should not be used as a basis for decisionmaking. It is important to reiterate here the potential benefits of waiting fifty years before transporting irradiated nuclear fuel so that the material will be much less radioactive and thus less deadly in the likely event of an accident.

Response
The transportation analysis presented in the EIS is based on the latest reasonably available information on the performance of spent nuclear fuel casks during transportation accidents. The EIS does not assume that accidents would not occur. Instead, the EIS evaluates both the radiological and nonradiological impacts of transportation accidents (see Chapter 6 and Appendix J of the EIS). The EIS uses standard, well-accepted methods to estimate transportation impacts in a realistic, yet conservative manner, and consequently DOE does not believe that impacts are underestimated or are unreliable, and does believe that the estimates are appropriate for decisionmaking.

While it is true that spent nuclear fuel would be less radioactive in 50 years, the impacts from transporting spent nuclear fuel are already very low, so waiting 50 years would not provide a practical reduction in the already very low risks.

8.8.1 (8975)
Comment - EIS001040 / 0017
Where are the evaluations of costs, risks and route specific data on possible accidents, population density, weather?

Response
Section 2.1.5 of the EIS provides information on the costs of the Proposed Action, including the cost of waste acceptance, storage, and transportation (nationally $4.5 billion and in Nevada $0.8 billion). Section 6.2 addresses the impacts of transporting spent nuclear fuel and high-level radioactive waste from generation or storage facilities to the proposed repository. The analyses in that section covered both incident-free transportation and potential accidents. Appendix J discusses the methods and data used for those analyses, including population and weather data.

8.8.1 (9055)
Comment - EIS001284 / 0007
WHEREAS, there are many unanswered questions regarding the safety of transporting and storing radioactive waste.

Response
Based on the results of the impact analyses presented in Chapter 6 and Appendix J of the EIS, as well as the results published in numerous other studies and environmental impact analyses cited in the EIS, DOE is confident spent nuclear fuel and high-level radioactive waste can be and would be safely transported to Yucca Mountain. DOE believes, as the EIS reports, that the potential impacts of this transportation would be so low for individuals who live and work along the routes that these individual impacts would not be discernible even if the corresponding doses could be measured. The analysis presented in the EIS factored in the characteristics of spent nuclear fuel and high-level radioactive waste, the integrity of shipping casks that would be used in transport, and the regulatory and programmatic controls that would be imposed on shipping operations (see Appendix M). The EIS analytical results are supported by numerous technical and scientific studies which have been compiled through decades of research and development by DOE and other Federal agencies of the United States, including the Nuclear Regulatory Commission and the U.S. Department of Transportation, as well as by the international community, including the International Atomic Energy Agency.

DOE believes that the EIS adequately analyzes transportation-related impacts that could result from the Proposed Action. DOE also believes that the EIS provides the information necessary to make decisions on the basic approaches to transporting spent nuclear fuel and high-level radioactive waste (either rail or truck shipments), as well as the choice among alternative rail corridors in Nevada, if the site is approved. The reader is referred to the introduction to Chapter 8 of the CRD for additional information.

8.8.1 (9215)
Comment - EIS001938 / 0004
The DEIS fails to detail and analyze the transportation corridors that will be utilized to transport high-level nuclear waste to Yucca Mountain, which are an integral part of the repository project.

The DEIS fails to adequately address the issue of transport of high-level radioactive waste along state and U.S. highway systems, saying that it is not relevant to the decision being made. Without a decision to store radioactive waste at Yucca Mountain this EIS would not be prepared, thus not only is the issue of waste transport relevant, it must be analyzed in this EIS. See 40 CFR 1508.25 (Re: Scope of an EIS. Connected actions, e.g., those which are interdependent part of a larger action and depend on the larger action for their justification, should be analyzed in the same impact statement.) Without a detailed assessment of proposed routes for the transportation of high-level radioactive waste, it is impossible for the reader of the document or the decisionmaker to fully understand the (in this case) likely and significant impacts of the proposed action on the human and natural environment.

For instance, it is our understanding that State Route (SR) 127 is one of the routes of choice for transport of waste to Yucca Mountain. How will transport of high-level radioactive waste along this key access route to DVNP [Death Valley National Park] affect visitation to the Park? How, in turn, will a possible decrease in visitation to DVNP via SR 127 affect the economies of communities that lie along the transportation corridor (e.g., Tecopa, Shoshone, Death Valley Junction)? Is SR 127 a feasible route for transport of high-level radioactive waste from an engineering standpoint? Are the communities along SR 127 adequately equipped, from an emergency response standpoint, to handle likely catastrophic consequences to both humans and the environment in the event of a reasonably foreseeable accident-related spill? The DEIS has failed to address and resolve these significant issues.

Impacts to natural resources of DVNP, Ash Meadows NWR and designated Wilderness from a transportation-related accident could likewise be disastrous and should be considered in the revised EIS. Were a spill to occur in or near the Amargosa River it would destroy this important desert riparian system. Spills could -- and would -- decimate vegetation and kill wildlife. Death Valley National Park is likewise put at risk, since much of SR 127 constitutes the boundary of Death Valley National Park.

It is unclear what other routes of travel might be used beyond SR 127. Information indicates that Great Basin National Park and Lake Mead National Recreation Area might also enjoy the dubious distinction of being within the realm of transport of high-level nuclear waste. What are possible impacts to these protected areas in the event of a hazardous spill? Beyond the possible impacts to the human and natural environments from a hazardous spill, how might transport of high-level waste adjacent to other protected places in the country affect visitation to Parks and local attractions, local economics, etc?

In conclusion, the threat of disastrous accidents from transportation-related spills is very real, and needs to be comprehensively addressed in this document. The revised DEIS needs to include a clear description of transportation routes that reflects a careful consideration of potential hazards and problems with each selected route, and a thorough description of the stringent safety and mitigation measures that will be adopted in order to ensure protection of both natural resources and communities in the Death Valley region and beyond.

Response
At this time, years before shipments could begin, it is impossible to predict accurately which highway routes or rail lines DOE could use for all shipments. Before such shipments began, states and tribes could designate alternate preferred highway shipping routes, and highways and rail lines could be built or modified. Therefore, for the analysis in this EIS, DOE selected potential highway routes in accordance with U.S. Department of Transportation regulations, which require the use of preferred routes (typically highways and bypasses that are part of the Interstate Highway System). The Department based its selection of potential rail routes for use in the analysis on current rail practices, because there are no comparable Federal regulations applicable to the selection of rail routes for the shipment of radioactive materials.

In response to public comments, DOE included maps of the highway routes and rail lines it used for analysis in Section J.4 of the EIS. It also included potential health and safety impacts associated with shipments for each state through which the routes used in the analysis pass. These numbers should be considered tentative, as there are many factors that could cause the modes and routes to change including reactor operations, trading of pickup allocations,

selection of a different transportation mode for shipments by the reactor operator, or recommendation of alternate routes by states or tribes. Impacts in individual states could be different if the actual routes from generator sites to Yucca Mountain are different from those analyzed. However, it is not likely that the total impacts from transportation would be changed significantly or that any particular route connecting an origin/designation pair would present a significant difference in impact from any other.

Following U.S. Department of Transportation regulations, truck shipments in Nevada would enter the State on Interstate-15 and proceed to the planned beltway and then to U.S. 95 and the repository unless the State designated alternate routes. In addition to analyzing the impacts of using highway routes that would meet Department of Transportation requirements for transporting spent nuclear fuel, DOE evaluated how the estimated impacts would differ if legal-weight trucks used other routes in Nevada. As a sensitivity analysis, six other routes identified by a Nevada DOT study were evaluated. Two of these routes used SR 127. The results of this analysis are reported in Section J.3.1.3 of the EIS. None of these routes would be used unless they were designated by the routing agencies of the affected states.

"Real-life conditions" that would involve various types of collisions (such as airplanes and military trucks with explosives), various natural disasters, specific locations (such as mountain passes), or various infrastructure accidents (such as track failure) in effect constitute a combination of cask failure mechanisms, impact velocities, and temperature ranges, which the EIS does evaluate. DOE has revised the EIS to describe the maximum reasonably foreseeable accident in terms of cask failure mechanisms, range of impact velocities, and temperature range.

As described in Section M.5 of the EIS, as with any transportation accident, state and tribal governments have primary responsibility to respond to and protect the public health and safety in their jurisdictions in accidents involving radioactive materials. This includes providing, managing, and maintaining responsibility for emergency response capabilities. Although DOE would originally provide the funding for training, each state and tribe would determine how it wants to administer that funding. Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for training of public safety officials of appropriate units of local government and tribes through whose jurisdictions it would transport spent nuclear fuel and high-level radioactive waste. The training would cover procedures required for safe routine transportation of these materials, as well as procedures for dealing with emergency response situations. DOE would provide the assistance based on the training needs of the states and tribes, as they determined using an up-front planning grant and based on availability of funds in annual Program budgets specified by Congress.

8.8.1 (9265)
Comment - EIS000325 / 0004
Now, we know the industry here will do a good job to start off with, but we're talking about a 30-year program. And so those shipments in Germany have been canceled and they're on hold because of the kind of sloppiness that you can except to see in a program here. So I'm just saying if we're going to talk about the international experience, let's talk about all of it.

Response
In response to comments, DOE has provided information in Appendix M of the EIS on the regulations that govern the transportation of spent nuclear fuel and high level radioactive waste. Details on the proposed operational aspects of the transportation program are also provided in Appendix M. Together, the strict transportation regulations and the detailed operational program should ensure that that a high level of quality is maintained throughout the transportation program.

DOE recognizes that human and organizational factors are important contributors to the occurrence of accidents, including transportation accidents, and recognizes that there is a potential for the performance of one or more transportation system components to degrade over time as operations become routine and repetitive. However, the contributions of human and organizational factors to the total accident risks are not explicitly analyzed in the EIS. Because the truck and rail accident rates used in the EIS include accidents from all potential causes, including those with human or organizational root causes, providing additional details on such factors would not appreciably change the results presented in the EIS.

8.8.1 (9303)
Comment - EIS001888 / 0028
The DEIS used outdated databases, geographic data files, and inaccurate or misleading maps to support the conclusions of the transportation, health effects and public safety analyses.

Response
In this EIS, DOE has used computer models it has used in previous EISs and other studies. These models are widely accepted by the national and international scientific and regulatory communities. For instance, DOE selected the RADTRAN 5 computer program to estimate radiological impacts to populations from incident-free transportation and from accidents. RADTRAN, which was originally developed by Sandia National Laboratories in the late 1970s, has been used in many other previous DOE EISs, and it has undergone periodic review and revision. In 1995, an independent review of RADTRAN 4 (immediate predecessor to RADTRAN 5) demonstrated that it yielded acceptable results when compared to "hand" calculations. More recently, an independent review found that RADTRAN 5 overestimates the measured radiation dose to an individual from moving radiation sources.

To ensure that the EIS analyses reflect the latest reasonably available information, DOE has either incorporated information that has become available since the publication of the Draft EIS or modified existing information to accommodate conditions likely to be encountered over the life of the Proposed Action. For example, the analysis in the Draft EIS relies on population information from the 1990 Census. In this Final EIS, DOE has scaled impacts upward to reflect the relative state-by-state population growth to 2035, using 2000 Census data.

DOE believes that the EIS adequately analyzes transportation-related impacts that could result from the Proposed Action. DOE also believes that the EIS provides the information necessary to make decisions on the basic approaches to transporting spent nuclear fuel and high-level radioactive waste (either rail or truck shipments), as well as the choice among alternative rail corridors in Nevada, if the site is approved. The introduction to Chapter 8 of this Comment-Response Document contains additional information.

8.8.1 (9401)
Comment - EIS001888 / 0099
The DOE adopted an unorthodox strategy in preparing the DEIS. Ignoring thirty years of best practice in the preparation of environmental impact statements, DOE chose to adopt the narrowest possible definition of an EIS and its purpose. In doing this, the DOE ensured that it found no impacts. The transportation analysis is typical of this approach. For example, the DEIS did not study traffic impacts that are normally considered in an EIS, choosing to base the estimation of transportation Impacts solely on the risk of population and worker exposure to radiation. Congestion, lane widths, shoulder widths, peak hour traffic, roadbed conditions, and other conventional measures of traffic impacts were ignored. By narrowing the range of impacts studied, DOE made certain that the DEIS would identify no substantive transportation impacts.

Response
DOE believes that the EIS adequately analyzes environmental impacts that could result from the Proposed Action. This belief is based on the level of information and analysis, the analytical methods and approaches used to represent conservatively the reasonably foreseeable impacts, and the use of bounding assumptions where information is incomplete or unavailable, or where uncertainties exist. The use of widely accepted analytical tools, latest reasonably available information, and cautious but reasonable assumptions offer the most appropriate means to arrive at conservative estimates of transportation-related impacts.

For the reasons discussed above, DOE believes that the EIS provides the environmental impact information necessary to make certain broad transportation-related decisions, namely the choice of a national mode of transportation outside Nevada (mostly rail or mostly legal-weight truck), the choice among alternative transportation modes in Nevada (mostly rail, mostly legal-weight truck, or heavy-haul truck with use of an associated intermodal transfer station), and the choice among alternative rail corridors or heavy-haul truck routes with use of an associated intermodal transfer station in Nevada. DOE has identified mostly rail as its preferred mode of transportation, both nationally and in Nevada. At this time, however, the Department has not identified a preference among the five candidate rail corridors in Nevada.

In addition to radiological health impacts, the transportation analysis presented in the EIS considers traffic congestion and peak-hour traffic in EIS Sections 6.3.1 and 6.3.3.1. The preliminary design analyzed in the EIS included an analysis of lane and shoulder width along with roadbed conditions, see CRWMS M&O (DIRS 154448-1998). Thus, the EIS considers potential impacts other than fatalities where it is necessary to support the broad transportation-related decisions given above.

8.8.1 (9406)
Comment - EIS001888 / 0102
There is an increased interest in risk assessment methodologies that better characterize and quantify uncertainty. The National Academy of Sciences has stated that, "Whenever possible, (upper bound potency estimates) should be supplemented with other descriptions of cancer potency that might more adequately reflect the uncertainly associated with the estimates." The National Research Council has made a similar call for a characterization of uncertainty. However, the estimates in the DEIS were presented as authoritative statements of risk, and the high degree of uncertainty in the estimates was left unstated. In order for the DEIS to have credibility with the public and policymakers, the DOE should have pursued an assessment strategy that addressed uncertainty rather than ignored it.

Response
DOE is aware that there are uncertainties associated with the transportation impact results presented in the EIS. There are uncertainties associated with route characteristics, demographics, weather, atmospheric dispersion models, waste characteristics, accident rates, release fractions, and many other elements of the risk assessments. Because one of DOE's goals is to choose between alternatives, the consistent consideration of uncertainty among alternatives means that the relative differences in impact estimates among alternatives should not be affected. To account for uncertainties in the data, conservative assumptions were made so the impacts reported in the EIS would bound the potential impacts. Examples of conservative assumptions include: accident release fractions which were selected from the high end of the distribution of experimental results, regulatory maximum radiation dose rates were assumed for all shipments, even though the actual dose rates would be significantly lower for most shipments, consequences to maximally exposed individuals were presented for 50 percent and 95 percent (for example, consequences exceeded only 5 percent of the time) meteorological conditions, and evacuation and sheltering, which could reduce radiological exposures, were not included in the accident risk calculations. DOE has chosen not to use conservative assumptions in all cases, as this practice tends to produce unrealistic and improbable results. Consistent with Council on Environmental Quality regulations (40 CFR 1502.22), DOE is attempting to avoid compounding conservatisms, yielding unrealistic results, in analyzing environmental impacts. Such practices mask the real differences and would not produce suitable results to support choices among the alternatives.

8.8.1 (9552)
Comment - EIS001888 / 0225
The DOE adopted a peculiar strategy in preparing the DEIS. Ignoring thirty years of best practice in the preparation of Environmental Impact Statements, the DOE chose to adopt the narrowest possible definition of impacts. By narrowly defining what an EIS is and what an EIS is supposed to do, the DOE ensured that it found no impacts. The transportation analysis is emblematic of this approach. The DEIS did not study traffic impacts that are normally considered by an EIS. Congestion, lane widths, shoulder widths, peak hour traffic, roadbed conditions, and other conventional measures of traffic impacts are ignored. By narrowly defining impacts as solely radiological health impacts this ensures no substantive impacts will be identified by the DEIS. Another example is the emergency management section. By insisting that the DEIS is not an emergency planning document, the DOE avoided preparing any estimates of the costs necessary to mitigate the impacts of emergency response. This approach to impact assessment is consistent with other DOE impact assessments (notably the Nevada Test Site EIS), but does not conform to best practice in the field of impact assessment. While this approach may have facilitated speedy preparation of the DEIS, it did not result in a thorough analysis of the impacts of the program and violates the letter and spirit of NEPA [the National Environmental Policy Act].

Response
Section 6.3 of the EIS describes the various categories of information acquired to assess impacts of transportation in Nevada. These are the general categories usually addressed in National Environmental Policy Act documents. They include assessment of impacts of construction and operation on land use and ownership (including access, hunting, mining, and ranching), water resources, biological resources (including endangered species), occupational health

and safety, socioeconomics, noise, cultural resources, utilities and energy, flood plains, and other potential impact areas.

The EIS reflects a similar philosophy in its analyses to those that have been used in the past. In addition to radiological health impacts, the transportation analysis presented in the EIS considers traffic congestion and peak-hour traffic in EIS Sections 6.3.1 and 6.3.3.1. The preliminary design analyzed in the EIS included an analysis of lane and shoulder width along with roadbed conditions, see CRWMS M&O (DIRS 154448-1998). DOE believes that the EIS provides the information necessary to make decisions on the basic approaches to transporting spent nuclear fuel and high-level radioactive waste (either rail or truck shipments), as well as the choice among alternative rail corridors in Nevada environmental impact information necessary to make certain broad transportation-related decisions, namely the choice of a national mode of transportation outside Nevada (mostly rail or mostly legal-weight truck), the choice among alternative transportation modes in Nevada (mostly rail, mostly legal-weight truck, or heavy-haul truck with use of an associated intermodal transfer station), and the choice among alternative rail corridors or heavy-haul truck routes with use of an associated intermodal transfer station in Nevada if the site was approved. However, follow-on implementing decisions, such as the selection of a specific rail alignment in a corridor, or the specific location of an intermodal transfer station in Nevada or the need to upgrade heavy-haul truck routes, would require additional field surveys, State and local government and Native American tribal consultations, environmental and engineering analyses, and the appropriate National Environmental Policy Act reviews.

It is the Department's opinion that the EIS adequately analyzes impacts of and emergency planning for transporting spent nuclear fuel and high-level radioactive waste.

8.8.1 (9554)
Comment - EIS001888 / 0227
There is an increased interest in risk assessment methodologies that better characterize and quantify uncertainty. The National Academy of Sciences has stated that, "Whenever possible, (upper bound potency estimates) should be supplemented with other descriptions of cancer potency that might more adequately reflect the uncertainly associated with the estimates." The National Research Council has made a similar call for a characterization of uncertainty. However, the estimates in the DEIS were presented as authoritative statements of risk, and the high degree of uncertainty in the estimates was left unstated. In order for the DEIS to have credibility with the public and policymakers, the DOE should have pursued an assessment strategy that addressed uncertainty rather than ignored it.

Response
DOE is aware that there are uncertainties associated with the transportation impact results presented in the EIS. There are uncertainties associated with route characteristics, demographics, weather, atmospheric dispersion models, waste characteristics, accident rates, release fractions, and many other elements of the risk assessments. Because one of DOE's goals is to choose between alternatives, the consistent consideration of uncertainty among alternatives means that the relative differences in impact estimates among alternatives should not be affected. To account for uncertainties in the data, conservative assumptions were made so the impacts reported in the EIS would bound the potential impacts. Examples of conservative assumptions include: accident release fractions which were selected from the high end of the distribution of experimental results, regulatory maximum radiation dose rates were assumed for all shipments, even though the actual dose rates would be significantly lower for most shipments, consequences to maximally exposed individuals were presented for 50 percent and 95 percent (for example, consequences exceeded only 5 percent of the time) meteorological conditions, and evacuation and sheltering, which could reduce radiological exposures, were not included in the accident risk calculations. DOE has chosen not to use conservative assumptions in all cases, as this practice tends to produce unrealistic and improbable results. Consistent with Council on Environmental Quality regulations (40 CFR 1502.22), DOE is attempting to avoid compounding conservatisms, yielding unrealistic results, in analyzing environmental impacts. Such practices mask the real differences and would not produce suitable results to support choices among the alternatives.

8.8.1 (9572)
Comment - EIS001888 / 0246
The software used to analyze transportation risk in the DEIS was RADTRAN version 4.019. Extensive criticism of RADTRAN has been made in other venues. Although courts have allowed RADTRAN's analysis of risk, the many shortcomings of this approach should be examined in the DEIS. In particular, the DEIS should have provided the

full RADTRAN outputs and interpreted their meaning. A portion of these outputs would have been the decontamination costs should an accident occur.

Response
Sections 6.2.1 and J.1.1 of the EIS describe in some detail the codes used, including RADTRAN, and the results they generate. Criticisms of RADTRAN were specifically discussed in Sections 3.3 and 4.3 of the report *Validation of the Transportation Computer Codes HIGHWAY, INTERLINE, RADTRAN4, and RISKIND* (DIRS 101845-Maheras and Pippen 1995). Many of the criticisms were related to previous versions of RADTRAN. Other criticisms were related to data used in other analyses, and as such are not directly related to the analyses presented in the EIS. RADTRAN 4 output for the analyses in the Draft EIS and RADTRAN 5 analyses in the Final EIS were provided to the commenter on compact disk. DOE conducted a literature review on the subject of potential cleanup costs and summarized the results in Section J.1.4.2.5.

8.8.1 (9585)
Comment - EIS001888 / 0260
Transportation System Description

The DEIS is insufficient because it fails to provide any description of the complex system that will be needed to transport SNF on the scale proposed in the DEIS. Without such a description, an assessment of the impacts of transporting waste is impossible. DOE has recognized the importance of this problem in the past, but has not addressed it in the DEIS. In previous documents, DOE identified the following components of the transportation system: Transportation Cask Systems, Service and Maintenance Support, Field Operations, and Planning and Control.

Substantial questions are raised in the DEIS but not answered. The response of the DOE to questions about the system used to move waste from origin sites to the final repository has been that there are many unknowns in the transportation system and that final study of the system requires determination of site suitability. There are two problems with this argument.

First, is that the information contained in the DEIS will be used by Congress to make decisions about the disposal program. By presenting admittedly piecemeal and incomplete information, the DOE opens itself to charges that it was disingenuous with Congress and the American people. The DOE should remedy this problem by clearly labeling those areas in the DEIS where the information is untrustworthy and incomplete. The second flaw in the DOE's argument is that it assumes that once the site is selected, it will be possible to transport the waste. By failing to provide a comprehensive, credible study of the transportation system, the DOE gives the misleading impression that only site characterization is an important issue. In other words, only site characterization is a relevant issue. Given the quality of the DEIS' analysis, this does not seem likely.

Response
DOE believes that the EIS adequately analyzes environmental impacts that could result from the Proposed Action. This belief is based on the level of information and analysis, the analytical methods and approaches used to represent conservatively the reasonably foreseeable impacts, and the use of bounding assumptions where information is incomplete or unavailable, or where uncertainties exist. The use of widely accepted analytical tools, latest reasonably available information, and cautious but reasonable assumptions offer the most appropriate means to arrive at conservative estimates of transportation-related impacts.

DOE is aware of the hazards associated with spent nuclear fuel and high-level radioactive waste. DOE is also aware that the transportation system needed to ship these materials to the proposed repository would be complex, consisting of many interrelated components. However, the single most important components of the transportation system would be the Type B shipping casks. DOE would use casks certified by the U.S. Nuclear Regulatory Commission to meet the requirements of the Commission's transportation regulations in 10 CFR Part 71.

Another important component of the transportation system would be field operations, planning, and control of the shipments. DOE has developed a draft Request for Proposal for Regional Servicing Contractor(s) for waste acceptance and transportation. Section M.3 of the EIS describes the draft Request for Proposal. The selected contractor(s) would be responsible for shipping arrangements and transportation services in the servicing region(s).

For the reasons discussed above, DOE believes that the EIS provides the environmental impact information necessary to make certain broad transportation-related decisions, namely the choice of a national mode of transportation outside Nevada (mostly rail or mostly legal-weight truck), the choice among alternative transportation modes in Nevada (mostly rail, mostly legal-weight truck, or heavy-haul truck with use of an associated intermodal transfer station), and the choice among alternative rail corridors or heavy-haul truck routes with use of an associated intermodal transfer station in Nevada. DOE has identified mostly rail as its preferred mode of transportation, both nationally and in Nevada. At this time, however, the Department has not identified a preference among the five candidate rail corridors in Nevada.

If the Yucca Mountain site was approved, DOE would issue at some future date, a Record of Decision to select a mode of transportation. If, for example, mostly rail was selected (both nationally and in Nevada), DOE would identify a preference for one of the rail corridors in consultation with affected stakeholders, particularly the State of Nevada. In this example, DOE would announce a preferred corridor in the *Federal Register* and other media. No sooner than 30 days after the announcement of a preference, DOE would publish its selection of a rail corridor in a Record of Decision. A similar process would occur in the event that DOE selected heavy-haul truck as its mode of transportation in Nevada. Other transportation decisions, such as the selection of a specific rail alignment within a corridor, would require additional field surveys, State and local government and Native American tribal consultations, environmental and engineering analyses, and appropriate National Environmental Policy Act reviews.

8.8.1 (9589)
Comment - EIS001888 / 0263
Specialty Casks

A fundamental advantage of intermodal handling is to reduce accidents through uniform packaging. The questions raised about the MPC [multipurpose canister] are equally pertinent to the numerous specialty casks that must be designed to meet the needs of the other waste forms the DEIS proposes to dispose of in Yucca Mountain. Questions about the characteristics, designs and certification for the other waste forms are the same as for the MPC. The DEIS is mute on the significant problems of handling different waste forms and potentially different waste packages at Yucca Mountain and the intermodal facilities where the waste will be handled.

Response
DOE has considered the potential difficulties in handling different waste forms and waste packages at Yucca Mountain and different models of shipping casks the candidate intermodal transfer facilities. The Department is aware that special handling equipment and procedures could be necessary for each type of waste, waste package, and shipping cask it would handle and foresees no significant problems associated with handling at the proposed repository or an intermodal transfer facility. According to the Draft Request for Proposal for Waste Acceptance and Transportation Services (see Section M.3 of the EIS), a Regional Service Contractor(s) would be responsible for providing the equipment to handle and prepare each transportation cask for unloading. The contractor(s) would provide training on the use of the equipment and operating procedures and maintenance procedures for the equipment (including shipping casks and ancillary handling equipment). The contractor(s) would develop more detailed planning for providing these services at the repository and the selected intermodal transfer facility in the initial phase of the contract(s).

8.8.1 (9596)
Comment - EIS001888 / 0270
In-Transit Storage

It is inevitable that delivery schedules will be delayed or interrupted. The impacts of moving waste uninterrupted from the origin to the destination for a single shipping campaign are different from a complex, multi-state shipping campaign that will take place over a period of years. The DEIS transportation plan should have addressed the likely effects of in-transit storage on the risks of transporting waste. Storage in-transit is a likely event and the DEIS should describe the DOE's plans to manage that requirement and describe the amount of waste that may have to be stored in transit to the Yucca Mountain facility.

Response
In-transit storage of spent nuclear fuel and high-level radioactive waste shipments would not occur. Shipments would travel nonstop from waste generator facilities to the proposed repository, with necessary stops for food, refueling, rail classifications, and en route inspections. However, DOE recognizes that not all shipments would proceed uninterrupted. Weather, traffic, and road and rail conditions could interrupt continuous movement of a shipment from its origin to the destination. For this reason, DOE would use a satellite tracking communication system such as TRANSCOM and for the shipments. The TRANSCOM system is capable of real-time communications with truck crews and rail escorts and DOE could use it to warn them of upcoming delays and other adverse conditions. It would then be possible to reroute a shipment over an alternative route to avoid the adverse conditions. As an alternative, shipments could proceed to safe parking areas where they could wait until the condition cleared and the trip could continue. Safe parking areas would be identified for each route and the information made available to crew members and carried with the shipment, as discussed in Section M.3.2 of the EIS.

An incident that required the use of a safe parking area would be unlikely. The radiation doses from such an incident would be small, because the number of people exposed and the likely exposure durations would be smaller than those for a routine shipment. DOE believes that the combined low likelihood of occurrence and low radiation doses from a safe parking incident would not contribute significantly to the transportation impacts presented in the EIS. As a consequence, DOE has not evaluated such impacts in the EIS.

8.8.1 (9612)
Comment - EIS001888 / 0284
The DEIS should be rescinded and a new DEIS issued that 1) assesses traditional transportation impact concerns, 2) State of Nevada identified routes, 3) bypass routes (should the northern beltway become unavailable), 4) describe why the Air force was awarded special status and Clark County was not, and 5) describe the process used to select one or more implementing alternatives.

Response
The EIS addresses "traditional" transportation impacts (traffic congestion, accident rates, and traffic volume) at a level of detail sufficient for DOE to make a mode and route selection (see Section 6.3). DOE's analyses for legal-weight truck transport concludes that existing highways are sufficient and, though upgrades would be necessary for a selected heavy-haul truck route, existing rights-of-way would be sufficient. Section J.3.1.3 contains an analysis of State of Nevada-identified routes.

Public comments submitted to DOE during hearings on the scope of the EIS resulted in the addition of a fifth rail corridor and heavy-haul truck route, the Caliente-Chalk Mountain Corridor and Caliente/Chalk Mountain heavy-haul truck route. However, the U.S. Air Force has expressed concern that for reasons of national security it cannot envision any route through the Nellis Air Force Range that would not conflict with its training and testing mission. For this reason, the Caliente-Chalk Mountain Corridor and Caliente/Chalk Mountain heavy-haul truck route are listed in the EIS as nonpreferred alternatives.

Protocols for Regional Servicing Contracts given in Section M.3 of the EIS describe how the contractors would develop transportation plans, including selection of routes and modes.

If the Yucca Mountain site was approved, DOE would issue at some future date a Record of Decision to select a mode of transportation. If, for example, mostly rail was selected (both nationally and in Nevada), DOE would identify a preference for one of the rail corridors in consultation with affected stakeholders, particularly the State of Nevada. In this example, DOE would announce a preferred corridor in the *Federal Register* and other media. No sooner than 30 days after the announcement of a preference, DOE would publish its selection of a rail corridor in a Record of Decision. A similar process would occur in the event that DOE selected heavy-haul truck as its mode of transportation in Nevada. Other transportation decisions, such as the selection of a specific rail alignment within a corridor, would require additional field surveys, State and local government and Native American tribal consultations, environmental and engineering analyses, and appropriate National Environmental Policy Act reviews.

8.8.1 (9613)
Comment - EIS001888 / 0285
National Route Selection

The DEIS is incomplete due to its failure to analyze the impact of transporting SNF [spent nuclear fuel] across the nation. Of 146 pages in the transportation section of the report, only 17 pages are devoted to national transportation of Spent Nuclear Fuel. The Problem of selecting routes on which to transport radioactive materials has incited litigation and defied every attempt at reaching consensus. The problems associated with route selection begin with construction at Yucca Mountain and flow back to each of the generating sites. Each suite of routes poses different risk characteristics nationally as well as in the State of Nevada. The DEIS assumes that truck and rail shipments on different routes possess the same risk characteristics. The DEIS presents the shortest distances to transport the waste without considering any of the likely alternatives to shortest distance.

Response
Chapter 6 and Appendix J of the EIS contain substantial analyses related to the national transportation of spent nuclear fuel and high-level radioactive waste. However, in response to comments, considerable state-by-state information has been added to Appendix J, which now includes maps for each state, including Federally recognized Native American Reservations, that show routes used in the analyses of impacts presented in the EIS, tables listing rail and truck shipments originating in and passing through each state, and incident-free and accident risk impacts for each state. Appendix M provides additional supplemental information related to the transportation of radioactive material, such as regulations, cask safety and testing, transportation services and protocols (including planning and route selection), emergency response, physical protection, and liability.

As discussed in Section J.1.4.2.3 of the EIS, state-specific accident rates and route-specific population density data were used to estimate transportation impacts. As a consequence, truck and rail shipments on different routes would possess different risk characteristics. In addition, the EIS does not present the shortest distance routes. For example, the truck routes were based on U.S. Department of Transportation routing regulations that recommend the use of beltways around cities. Using beltways around cities often results in routes that are longer than passing directly through these same cities. More details on transportation routing are in Section J.1.2.2, M.2.4, and M.3.2.1.2. Maps of the transportation routes analyzed in the EIS are in Section J.4.

8.8.1 (9630)
Comment - EIS001888 / 0299
In order for the DEIS to be a sufficient document, the practice of risk assessment used in the DEIS should conform to best practice in the field. Based on a comparison with the GEIS, it is not clear how a probabilistic risk assessment for transporting high level radioactive should be done. A primary requirement for the DOE is to recognize the unique circumstances of the planned transportation operations for which there is little or no historical experience and empirical data. The transportation of spent fuel from reactors to the proposed repository at Yucca Mountain has no parallel. Previous spent fuel transportation experience is qualitatively different from the proposed action. The DEIS should be withdrawn and replaced by new DEIS that performs a complete probabilistic risk assessment that is found to be sufficient by a qualified peer review committee.

Response
Over the past 3 decades, there have been more than 2,700 shipments of spent nuclear fuel in the United States with no releases of radioactive material due to a transportation accident. This excellent safety record is consistent with the overall highway and rail accident data. DOE used standard accepted analysis methods in the EIS, including probabilistic risk assessment, to estimate transportation impacts. Risk assessment accident data for commercial transport have been used in conjunction with analyses of cask performance to estimate risks associated with spent nuclear fuel transport. The approach is appropriate and widely accepted as the basis for credible risk assessment.

8.8.1 (9978)
Comment - EIS001888 / 0483
[Clark County summary of comments it has received from the public.]

Commenters said that the EIS should include a detailed description of all affected environments and impacts to those environments. More specifically, the analyses should include: (1) worst-case and mile-by-mile assessments of

potential impacts along transportation routes and the emergency-response measures along these routes; (2) the effects of the environment on the safety of waste shipments, including a discussion of the controversial nature of waste transport; (3) Retrievability of the waste, along with the disposition of the retrieved waste; (4) the economic, social, health, and psychological costs of transporting and storing the waste, including the costs of accidents; (5) negative effects on property values, businesses, and tourism near the site and along transportation routes; and (6) risk, risk perception, and stigmatization.

Response

1. Section J.1.4.2 of the EIS has been revised to include a description of the maximum reasonably foreseeable accident. As in the Nuclear Regulatory Commission report *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000), the description is in terms of cask failure mechanism, impact velocity range, and temperature range for the accident. Accidents are not described in terms of specific circumstances, because various accidents could lead to the same combination of cask failure mechanism, impact velocity range, and temperature range. However, event trees illustrate the different combinations of events that occur during an accident. This approach to accident analysis precludes the necessity for analyzing numerous specific cases involving various collisions (such as air planes and military trucks with explosives), various natural disasters, specific locations (such as mountain passes), or various infrastructure accidents.

   As described in Section M.5 of the EIS, as with any transportation accident, state and tribal governments have primary responsibility to respond and to protect the public health and safety in their jurisdictions in accidents involving radioactive materials. This includes providing, managing, and maintaining responsibility for emergency response capabilities. Although DOE would provide funding for training, each state and tribe would determine how it wants to administer that funding. Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for training of public safety officials of appropriate units of local government and tribes through whose jurisdictions it would transport spent nuclear fuel and high-level radioactive waste. Section 180(c) is discussed in Section M.6.

2. Section M.3 of the EIS provides a discussion of the protocols and procedures to be implemented by a Regional Servicing Contractor and its subcontractors under adverse weather or road conditions. Shipments would not be dispatched on a route where expected conditions would not comply with the requirements in the procedures. Weather forecasts would be obtained by the Regional Servicing Contractor as part of the preshipment planning. Forecasts for rain, snow, fog or high winds and tornado warnings would be considered in the determination of the shipment schedule. Shipments would not travel when severe weather conditions along routes or adverse road conditions made travel too hazardous to proceed.

   Nuclear Regulatory Commission regulations do not specifically address natural disasters such as earthquakes, floods, or tornadoes. However, numerous tests and extensive analyses, using the most advanced analytical methods available, have demonstrated that casks would provide containment and shielding even under the most severe kinds of accidents that occur. A study completed by Sandia National Laboratories for the Nuclear Regulatory Commission (DIRS 152476-Sprung et al. 2000) concluded that casks would continue to fully contain spent nuclear fuel in more than 99.99 percent of all accidents. DOE believes that information on planning and management of shipments for normal conditions as well as abnormal conditions caused by natural and manmade phenomena provided in the EIS is sufficient.

3. Section 122 of the NWPA requires DOE to maintain the ability to retrieve the materials emplaced in the repository in the event that a decision were made to retrieve them to protect public health and safety or the environment or to recover constituent parts of spent nuclear fuel. Although DOE does not anticipate that retrieval would be necessary, it would utilize the repository design to maintain the ability for future generations to retrieve these materials for at least 50 years and possibly for as long as 300 years after emplacement operations have begun (see Section 4.2.1 of the EIS).

4. In response to public comments, DOE has included a discussion on the costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews costs for cleanup presented in past studies, including a report used in the 1986 environmental assessment as well as information submitted by the State of Nevada in its public comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $9.4 billion. Cost data used in the studies included data compiled from

case studies involving actual cleanup of radioactive materials contamination. The studies address consequences for releases of radioactive materials in communities. Although the studies project high costs for clean up following severe accidents, the accidents evaluated are very unlikely and, as a consequence, DOE believes the economic risks of transportation accidents is very small.

5&6 In light of the comments received on the Draft EIS concerning perceived risk, DOE examined relevant studies and literature on perceived risk and stigmatization of communities to determine whether the state-of-the-science in predicting future behavior based on perceptions had advanced sufficiently since scoping to allow DOE to quantify the impact of public risk perception on economic development or property values in potentially affected communities (see Section 2.5.4 and Appendix N of the EIS). Of particular interest were those scientific and social studies carried out in the past few years that directly relate to either Yucca Mountain or to DOE actions such as the transportation of foreign research reactor spent nuclear fuel. DOE reevaluated the conclusions of previous literature reviews such as those conducted by the Nuclear Waste Technical Review Board and the State of Nevada, among others. DOE has concluded that:

- While in some instances risk perceptions could result in adverse impacts on portions of a local economy, there are no reliable methods whereby such impacts could be predicted with any degree of certainty
- Much of the uncertainty is irreducible, and
- Based on a qualitative analysis, adverse impacts from perceptions of risk would be unlikely or relatively small.

While stigmatization of southern Nevada can be envisioned under some scenarios, it is not inevitable or numerically predictable. Any such stigmatization would likely be an aftereffect of unpredictable future events, such as accidents, which would not be expected to occur. As a consequence, DOE addressed but did not attempt to quantify any potential for impacts from risk perceptions or stigma in this Final EIS.

8.8.1 (10023)
Comment - EIS001888 / 0517
[Clark County summary of comments it has received from the public.]

Transportation risk assessment methodology biased toward shortest path not optimal path. DOE needs to incorporate calculated risk, collateral risk, contectural [sic] risk, and perceived risk not just use probabilistic risk analysis (PRA).

Response
The transportation risk analysis is based on U.S. Department of Transportation routing regulations for trucks and railroad operating practices for trains. This does not necessarily yield the shortest path for a route from a particular origin to a destination. The EIS uses standard and well-accepted transportation analysis methods, including probabilistic risk assessment, to estimate transportation impacts.

In light of the comments received on the Draft EIS concerning perceived risk, DOE examined relevant studies and literature on perceived risk and stigmatization of communities to determine whether the state-of-the-science in predicting future behavior based on perceptions had advanced sufficiently since scoping to allow DOE to quantify the impact of public risk perception on economic development or property values in potentially affected communities (see Section 2.5.4 and Appendix N of the EIS). Of particular interest were those scientific and social studies carried out in the past few years that directly relate to either Yucca Mountain or to DOE actions such as the transportation of foreign research reactor spent nuclear fuel. DOE reevaluated the conclusions of previous literature reviews such as those conducted by the Nuclear Waste Technical Review Board and the State of Nevada, among others. DOE has concluded that:

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While stigmatization of southern Nevada can be envisioned under some scenarios, it is not inevitable or numerically predictable. Any such stigmatization would likely be an aftereffect of unpredictable future events, such as accidents, which would not be expected to occur. As a consequence, DOE addressed but did not attempt to quantify any potential for impacts from risk perceptions or stigma in this Final EIS.

8.8.1 (10025)
Comment - EIS001888 / 0520
[Clark County summary of comments it has received from the public.]

DOE's approach to risk assessment is limited to PRA [probabilistic risk assessment]. Should include Calculated Risk, DOE's approach Risk, Contextual Risk, and Perceived Risk. Suggested starting point 1993 draft Identification of Factors for Selecting Modes and Routes for Shipping HLW [high-level radioactive waste] & SNF [spent nuclear fuel].

Response
As described in Section 6.2.1 and J.1.1 of the EIS, DOE uses standard and well-accepted transportation analysis methods, including probabilistic risk assessment, to estimate transportation impacts. Consistent with the *Final Report, Identification of Factors for Selecting Modes and Routes for Shipping High-Level Radioactive Waste and Spent Nuclear Fuel* (DIRS 103718-DOT 1998), the EIS evaluated incident-free radiological exposures, accident-induced radiological exposures, and the nonradiological consequences of accidents.

In light of the comments received on the Draft EIS concerning perceived risk, DOE examined relevant studies and literature on perceived risk and stigmatization of communities to determine whether the state-of-the-science in predicting future behavior based on perceptions had advanced sufficiently since scoping to allow DOE to quantify the impact of public risk perception on economic development or property values in potentially affected communities (see Section 2.5.4 and Appendix N of the EIS). Of particular interest were those scientific and social studies carried out in the past few years that directly relate to either Yucca Mountain or to DOE actions such as the transportation of foreign research reactor spent nuclear fuel. DOE reevaluated the conclusions of previous literature reviews such as those conducted by the Nuclear Waste Technical Review Board and the State of Nevada, among others. DOE has concluded that:

- While in some instances risk perceptions could result in adverse impacts on portions of a local economy, there are no reliable methods whereby such impacts could be predicted with any degree of certainty

- Much of the uncertainty is irreducible, and

- Based on a qualitative analysis, adverse impacts from perceptions of risk would be unlikely or relatively small.

While stigmatization of southern Nevada can be envisioned under some scenarios, it is not inevitable or numerically predictable. Any such stigmatization would likely be an aftereffect of unpredictable future events, such as accidents, which would not be expected to occur. As a consequence, DOE addressed but did not attempt to quantify any potential for impacts from risk perceptions or stigma in this Final EIS.

8.8.1 (10034)
Comment - EIS001888 / 0521
[Clark County summary of comments it has received from the public.]

Calculated risk (i.e. PRA [probabilistic risk assessment]) needs to be broader in scope and cumulative like RADTRANS.

Response
As discussed in Appendix J of the EIS, Version 5 of the RADTRAN computer code was used in estimating radiological risks of transportation activities. As discussed in Section 8.4, a comprehensive analysis of the cumulative impacts of transportation was performed. In addition, a broad range of impacts was evaluated: (1) radiological and nonradiological impacts, (2) incident-free and accident impacts, (3) individual impacts and population impacts, and (4) radiological risks and consequences.

8.8.1 (10035)
Comment - EIS001888 / 0522
[Clark County summary of comments it has received from the public.]

Contextual Risk results from unanticipated changes in risk environment. Example, an incident that delays movement of vehicle carrying HLW [high-level radioactive waste] increases risk to public/workers. Assessments should incorporate realistic public safety capabilities.

Response
The incorporation of public safety capabilities in the EIS analyses would reduce the reported impacts of transporting spent nuclear fuel and high-level radioactive waste to the proposed repository. As discussed in Section J.1.4.2 of the EIS, to bound the potential impacts of accidents the analyses did not take credit for or assume the mitigation effects provided by such public safety capabilities as accident prevention, emergency response interdiction, dose mitigation, or evacuation to reduce accident consequences. As described in Sections J.1.3.2 and J.1.4, scenarios like those described in the comment, such as an individual stuck in a traffic jam near a truck carrying spent nuclear fuel, and accidents where the cask was not damaged but would be delayed for a period before continuing to the repository, were analyzed in the EIS.

8.8.1 (10060)
Comment - EIS001888 / 0541
[Clark County summary of comments it has received from the public.]

Commenters asked questions about the methods or data to be used in the transportation assessments in the EIS, The use of "comprehensive risk assessment" was advocated by some commenters. Other commenters advocated a comprehensive systems analysis or a traffic impact analysis. Commenters stated that the EIS should rely upon previously published studies when possible.

Response
In this EIS, DOE has used computer models it has used in previous EISs and other studies. These models are widely accepted by the national and international scientific and regulatory communities. For instance, DOE selected the RADTRAN 5 computer program to estimate radiological impacts to populations from incident-free transportation and from accidents. RADTRAN, which was originally developed by Sandia National Laboratories in the late 1970s, has been used in many previous DOE EISs, and it has undergone periodic review and revision. In 1995, an independent validation review of RADTRAN 4 (immediate predecessor to RADTRAN 5) demonstrated that it yielded acceptable results when compared to "hand" calculations. More recently, an independent review found that RADTRAN 5 overestimates the measured radiation dose to an individual from moving radiation sources.

To ensure that the EIS analyses reflect the best latest reasonably available information, DOE has either incorporated information that has become available since the publication of the Draft EIS or modified existing information to accommodate conditions likely to be encountered over the life of the Proposed Action. For example, the analysis in the Draft EIS relies on population information from the 1990 Census. In this Final EIS, DOE has scaled impacts upward to reflect the relative state-by-state population growth to 2035, using 2000 Census data.

Although the EIS analyses are based on the best latest reasonably available information and state-of-the-art analytical tools, not all aspects of incident-free transportation or accident conditions can be known with absolute certainty. In such instances, DOE has relied on cautious assumptions that tend to overestimate impacts. For instance, DOE assumed that the radiation dose external to each vehicle carrying a cask during routine transportation would be the maximum allowed by U.S. Department of Transportation regulations. Similarly, DOE assumed that an individual, the "maximally exposed individual," would be a resident living 30 meters (100 feet) from a point where

all truck shipments, or 200 meters (660 feet) from a point where all rail shipments, would pass. Under these circumstances, the maximally exposed individual would receive a dose of about 6 millirem from exposure to all truck shipments, and a dose of about 2 millirem from exposure to all rail shipments (6 millirem represents an increased probability of contracting a fatal cancer of 3 in 1 million). Although it can be argued that individuals could live closer to these shipments, it is highly unlikely that an individual would be exposed to all shipments over the 24-year period of shipments to the repository, even though DOE incorporated this highly conservative assumption in the analysis.

The methods used to calculate transportation impacts are state-of-the-art. As a consequence, DOE believes the EIS adequately analyzes the environmental impacts that could result from the Proposed Action, including transportation. DOE believes the EIS fulfills all legal obligations required for an EIS and a "comprehensive risk assessment" or a "comprehensive systems analysis or traffic impact analysis" as advocated by the commenter is neither required nor necessary.

8.8.1 (10075)
Comment - EIS001888 / 0551
[Clark County summary of comments it has received from the public.]

Commenters were generally concerned that the EIS address various aspects of transportation, such as: cost; pre-notification requirements; insurance; comprehensive analysis of impacts; credible scenarios and alternatives; environmental effects; effects on infrastructure; planning; cask testing; safety; security; emergency response; routing; historical and future shipments; impacts on Native Americans; compliance with regulations and identification of assumptions.

Response
The commenters should refer to the following sections of the EIS in which the requested information is presented:

- Transportation costs are summarized in Section 2.1.5 for the Proposed Action (there are no transportation costs for the No-Action Alternative). See CRWMS M&O (DIRS 104980-1999) *Environmental Impact Statement Cost Summary Report*, for additional details.

- Prenotification requirements are addressed in Section M.2.5.

- Insurance is addressed in Section M.8.

- Comprehensive analyses of impacts, environmental effects, and effects on infrastructure are addressed in Chapter 6 and Appendix J.

- Planning for the shipments is discussed in Section M.3.

- Cask safety and testing is discussed in Section M.4.

- Security is discussed in Section M.7.

- Emergency response is addressed in Section M.5.

- Routing is addressed in Sections M.2.4 and M.3.2.1.2.

- Historic shipments are discussed in Section 8.4.1.2. Accident data for past radioactive material shipments are discussed in Section J.1.4.2.3.1 and in *Transportation Accidents/Incidents Involving Radioactive Material* (DIRS 102172-McClure and Fagan 1998). Future shipments of spent nuclear fuel and high-level radioactive waste to the proposed Yucca Mountain Repository are presented in Section J.1.2.

- Impacts on Native Americans are addressed as follows: the Ruby Valley Treaty issue is discussed in Section 3.1.1.4; Native American interests are presented in Section 3.1.6.2; Section 3.1.13 of the EIS describes the

minority or low income populations in Nevada; and Sections 6.3.4 and 8.4.2.12 address environmental justice impacts. Maps showing where minority or low-income populations are in relation to the site and the transportation corridors are provided in Section 3.1.1.3.

- Compliance with regulations is addressed in Chapter 11.

- Assumptions are explicitly identified throughout the EIS. A summary of DOE's approach to describing, documenting, and evaluating the effects of assumptions made where incomplete or unavailable data currently exists is presented in the EIS Section 2.5.

With respect to the comment on credible scenarios and alternatives, the transportation scenarios were constructed to bracket the total shipment volumes, which would be maximized for a nearly 100-percent mostly legal-weight truck scenario and minimized for a nearly 100-percent mostly rail scenario. DOE recognizes that many factors influence the selection of transport modes for the shipments, many of which are beyond its control, such as waste generator site operating characteristics, trading of acceptance rights, and cask handling capabilities at commercial nuclear powerplants. Since the actual mix of truck and rail shipments cannot be determined at this time, DOE evaluated two national transportation scenarios (mostly legal-weight truck and mostly rail) that bracket the actual mix of truck and rail shipments. DOE states in Section 2.1.1.3 of the EIS that it would determine the number of shipments by either mode as part of future planning efforts. Transport mode selection is further explained in Section M.3 and in the Request for Proposals for Waste Acceptance and Transportation Services (DIRS 153487-DOE 1998), located at *http://www.rw.doe.gov/wasteaccept/wasteaccept.htm*. Therefore, DOE believes it has employed realistic shipping scenarios that provide the information necessary to support the decisions to be made based on this EIS.

With respect to impacts on infrastructure, Section 3.2.1 of the EIS states that the shipments of spent nuclear fuel and high-level radioactive waste to the proposed repository represents a small fraction of current highway and rail traffic (0.006 percent of truck miles and 0.007 percent of rail miles per year). In addition, spent nuclear fuel and high-level radioactive waste truck and rail shipments would require no special highway or rail infrastructure that is not required for other hazardous commodities. The EIS presents the impacts of new infrastructure development within Nevada (see Section 6.3) because land acquisition and new construction would be needed to implement the Nevada rail and heavy-haul truck alternatives.

8.8.1 (10077)
Comment - EIS001888 / 0554
[Clark County summary of comments it has received from the public.]

Commenters stated that radiological and non-radiological impacts from transporting SNF [spent nuclear fuel] and HLW [high-level radioactive waste] should be evaluated in the ETS, for both workers and members of the public (including people along the route and people sharing the route). Cumulative health impacts and shipment of multi-purpose canisters also should be evaluated.

Response
The transportation impact analysis in Chapter 6 and Appendix J of the EIS includes the assessments for both workers and members of the public including people along the route and people sharing the route. The transportation impacts for several shipping casks, including multipurpose canisters are provided in Section 6 of the EIS. Cumulative impacts are given in Chapter 8.

8.8.1 (10142)
Comment - EIS001865 / 0017
Furthermore, the analysis in Appendix J appears to contain factual errors or misrepresentations. For example, it can be calculated from Table J-5 (page J-16) that 1,667 truck shipments from all four California commercial sites would take place during the 24-year operational period. However, when referring to Figure J-10 (page J-85) a small notation indicates that 6,250 truck shipments will enter Nevada on I-15 from California. Where do the extra 4,583 truck shipments come from? Likewise, it can be calculated from Table J-6 (page J-18) that 408 rail shipments from all four California commercial sites would take place during the 24-year operational period. However, when referring to Figure J-11 (page J-86) a small notation indicates that 1,837 rail shipments will enter Jean, Nevada from California. Where do the extra 1,429 rail shipments come from?

Response
Chapter 6 and Appendix J of the EIS contain substantial analyses related to the national transportation of spent nuclear fuel and high-level radioactive waste. However, in response to comments, considerable state-by-state information has been added to Appendix J which now includes maps for each state, including Federally recognized Native American Reservations, showing routes used in the analyses for the EIS and tables listing rail and truck shipments estimated to originate in and pass through each state, and incident-free and accident risk impacts for each state (see Section J.4).

8.8.1 (10300)
Comment - EIS001873 / 0080
Lincoln County Independent Research:

The County, under its federally funded Nuclear Waste Oversight Program, has produced numerous studies containing information concerning local impacts of the Yucca Mountain Project. As the County has stated in comments on the DEIS, the DOE has evidently not made any use of the County effort, which has cost approximately five million dollars to date. Following are some of the findings of the County studies. (My own observations are in parentheses.)

From Analysis of 46 mile rail corridor in Lincoln County 1986.

The study notes that 40% of the rail line is curved due to rugged terrain.

Braking is required for most of the route going south.

There is potentially a problem of the rail line being washed out due to flow from several side canyons under low clearance bridges. (One such low clearance bridge drains the site of the proposed Caliente Intermodal Facility. -LB)

A good percentage of the time the wind is towards Caliente from Rainbow Canyon (and the intermodal site) and would carry fallout from an accident to the town.

There is an average of 12 trains daily, and the average speed through the area is 32 mph.

There were 18 derailments between 1979 and 1981 involving 67 cars. Subsequently the record improved. (The current derailment record should be reviewed.)

Rocking of the cars on curves at 17 mph is a main cause of derailments, but trains must travel at this speed as they frequently speed up or slow down to negotiate the curves.

Sabotage potential is increased due to the remote and rugged nature of the area.

Emergency response in parts of the canyon areas would be next to impossible.

The Union Pacific RR Co. is not prepared to provide the needed level of emergency capability.

Mitigation measures identified include (1) a new rail line bypassing the area. (2) Implementing special train operations procedures. (3) Creation of a new organization to oversee HLW [high-level radioactive waste] shipments and react to sabotage threats.

Response
The types of information on the Caliente Corridor that Lincoln County produced are valuable for rail operations but are more detailed than necessary to support the decisions DOE would make based on this EIS. DOE would not base the choice of a rail corridor solely on environmental impacts; factors such as cost, schedule, procurement regulations, and others would influence the decision. The Department would continue to involve stakeholders in the decisions.

DOE believes that there are adequate rail lines, crossings, bridges, and tunnels nationally and in Nevada to support the transportation of materials described in the EIS. The shipment of radioactive materials requires no special transportation infrastructure that is not necessary for safe transport of commodities in the United States today.

Regional Servicing Contractor(s) for Waste Acceptance and Transportation Services would conduct detailed planning for rail service. DOE has issued a Draft Request for Proposal for one or more such contractors (available on the Internet at *http://www.rw.doe.gov/wasteaccept/wasteaccept.htm*; see Section M.3 of the EIS). Section C, Appendix 8, Paragraph 1.1 of the Draft Request for Proposal, "Mode Selection," states: "DOE requires, whenever possible, rail transport shall be used." As defined in Paragraph 2.2.7 of Section C, the transportation contractor must prepare a Transportation Plan that provides for "… maximum use of special train service and advanced rail equipment features where this type of service or equipment can be demonstrated to enhance operating efficiency, dependability, cost effectiveness or lessen the potential of adverse railroad equipment incidents."

DOE does not foresee a need to create a new organization to oversee shipments and react to sabotage threats. The U.S. Department of Transportation and the Nuclear Regulatory Commission provide independent Federal oversight of the transportation of spent nuclear fuel and high-level radioactive waste, including approval authority for the design, fabrication, and use of shipping containers, route selection, security, and other safety-related elements. States participate in and provide independent oversight of certain safety-related aspects of transportation, such as emergency preparedness and route selection.

8.8.1 (10356)
Comment - EIS001927 / 0007
The DOE must publish clear, truthful maps of the high-level waste/irradiated nuclear fuel transport routes to the proposed Yucca Mountain repository. The EIS must rigorously examine the risk involved in these shipments, and it must specify the exact mode of transportation – by train, truck, or barge. Site specific risk and potential impacts must be identified, to schools, hospitals, colleges, population centers, urban areas, agricultural lands, water and food storage, other vital resources, and natural areas along the routes. Increased risks of accidents due to extremes of weather or terrain must be analyzed, as well as the history of problems on these specific routes. In short, DOE should redo the entire national transport section of the EIS, and do it justice this time. DOE's failure to adequately assess transport impacts constitutes grounds for the withdrawal of the DEIS, and its re-issuance along with a new 180 day public comment period. Literally tens of millions of Americans have been kept in the dark by DOE – DOE concealed that fact that they live on irradiated fuel/high radioactive waste transport routes. Why did DOE do this?

Response
Comprehensive analyses of impacts, environmental effects, and effects on infrastructure are addressed in Chapter 6 and Appendix J of the EIS. In response to public comments, the transportation analysis in Appendix J was substantially revised. The EIS now includes maps of the truck and rail routes used in the analysis. Routing is addressed in Sections M.2.4 and M.3.2.1.2. These routes were used for analyzing transportation impacts in the EIS and are representative of the actual routes that would be used, which could be different. It is impossible for DOE to specify the exact mode of transportation for all shipments or the exact routes that would be used years before shipments began. As a result, DOE evaluated two national transportation scenarios (mostly legal-weight truck and mostly rail) that bracket the actual mix of truck and rail shipments. DOE states in Section 2.1.1.3 that it would determine the number of shipments by either mode as part of future planning efforts. Transport mode selection is further explained in Section M.3 and in the Draft Request for Proposals for Waste Acceptance and Transportation Services (DIRS 153487-DOE 1998), located at *http://www.rw.doe.gov/wasteaccept/wasteaccept.htm*. However, the Request for Proposals directs contractors to use special train service where it can be demonstrated to enhance operating efficiency and cost-effectiveness.

The EIS has been revised to include the estimated number of shipments and impacts for each state through which the analyzed routes would pass. The impacts at a particular location within a state, such as a town or city, would be less than the total for the state. The truck and rail accident rates used in the EIS include accidents of all causes and therefore account for past accidents, and extremes of weather and terrain.

DOE has provided information concerning the transportation routes used in the EIS in several different ways. For example, maps of the transportation routes were presented at each of the Draft EIS public hearings and a complete

set of transportation maps was placed on the Yucca Mountain Project web site well before the end of the public comment period. The state maps are provided in Section J.4 of the EIS.

8.8.1 (10575)
Comment - EIS001310 / 0006
Transportation of SNF [spent nuclear fuel] and HLW [high-level radioactive waste] is inherently risky business. The DEIS systematically and significantly understates the risks associated with shipments to the proposed repository in the following ways:

- The DEIS grossly underestimates routine radiation exposures to transportation workers, safety inspectors, and members of the public, especially along highway routes in Nevada.

- The DEIS significantly underestimates the human health consequences of severe transportation accidents resulting in release of radioactive materials, and ignores the social and economic impacts of severe accidents and post-accident cleanup activities.

- The DEIS significantly underestimates the human health consequences of successful terrorism and sabotage incidents involving high-energy explosive devices, and ignores the social and economic impacts of successful terrorism and sabotage incidents and post-incident cleanup activities.

Response
The transportation impact analysis, including the impacts of routine radiation exposures and consequences of severe accidents, was performed using current, reasonable, and valid methods and data available to DOE. DOE believes the analysis does not underestimate the impacts and, in fact, there are many instances in which the analysis is conservative, tending to overestimate impacts.

DOE is aware that there are uncertainties associated with the transportation impact results presented in the EIS. There are uncertainties associated with route characteristics, demographics, weather, atmospheric dispersion models, waste characteristics, accident rates, release fractions, and many other elements of the risk assessments. Because one of DOE's goals is to choose between alternatives, the consistent consideration of uncertainty among alternatives means that the relative differences in impact estimates among alternatives should not be affected.

To account for uncertainties in the data, conservative assumptions were made, so the impacts reported in the EIS considered the associated range of potential impacts. Examples of conservative assumptions include:

- Accident release fractions selected from the high end of the distribution of experimental results

- Regulatory maximum radiation assumed for all shipments, even though the actual dose rates would be significantly lower for most shipments

- Consequences to maximally exposed individuals presented for 50 percent and 95 percent (that is, consequences exceeded only 5 percent of the time) meteorological conditions

- Evacuation and sheltering, which could reduce radiological exposures, not included in the accident risk calculations

However, DOE has chosen not to use assumptions that would contain the same high degree of conservatism in all cases, as this practice tends to produce unrealistic and improbable results. Consistent with Council on Environmental Quality regulations (40 CFR 1502.22), DOE is attempting to avoid compounding conservatisms, yielding unrealistic results, in analyzing environmental impacts. Such practices mask the real differences and would not produce suitable results to support choices among the alternatives. Thus, for example, DOE has chosen to use realistic waste characteristics information, accident rates, highway and rail distances between waste generators and the proposed repository, and population demographics. DOE believes that the impacts presented in the EIS are not so conservative that the true differences among alternatives are masked.

The shipping cask performance data used to estimate the radiological risks of transporting spent nuclear fuel are from the *Reexamination of Spent Fuel Risk Estimates* (DIRS 152476-Sprung et al. 2000). These data represent the most recent and most thoroughly evaluated available information on the performance of shipping casks during severe transportation accidents.

The shipping cask performance data used to estimate the impacts of a successful sabotage event are from *Projected Source Terms for Potential Sabotage Events Related to Spent Fuel Shipments* (DIRS 104918-Luna, Neuhauser, and Vigil 1999). This report estimated maximum releases of radioactive material from the action of sabotage against a shipping cask containing spent nuclear fuel. The report considered 15 devices and chose two for detailed analyses. These data represent the most current and reasonable available information on the performance of shipping casks during a sabotage event.

Based on public comments on the Draft EIS, a discussion on the costs of cleanup has been added to Appendix J of the EIS. According to the Nuclear Regulatory Commission report, there would be no release of radioactive material from the cask in 99.99 percent of transportation accidents involving spent nuclear fuel (DIRS 152476-Sprung et al. 2000). The economic costs of accidents that did not have a release of radioactive material would be small.

In 0.01 percent of accidents some radioactive material could be released from the cask. Based on the studies discussed in Appendix J of the EIS, the economic costs of severe transportation accidents involving spent nuclear fuel could be in the range of as little as $200,000 to $270 billion. However, extreme cost estimates are for accidents where all factors are assumed to combine in the most detrimental way to maximize consequences. Such extreme, or worst-case, accidents are not reasonably foreseeable so the estimates of cost are not useful for comparisons. The probability of the accidents analyzed in the studies range from about 1 in 1 million per year to less than 1 in 1 trillion (1 followed by 11 zeros) per year.

For perspective, the current insured limit of responsibility for an accident involving releases of radioactive materials to the environment is $9.43 billion. The annual cost of transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain would be about $200 million.

In light of the comments received on the Draft EIS concerning perceived risk, DOE examined relevant studies and literature on perceived risk and stigmatization of communities to determine whether the state-of-the-science in predicting future behavior based on perceptions had advanced sufficiently since scoping to allow DOE to quantify the impact of public risk perception on economic development or property values in potentially affected communities (see Section 2.5.4 and Appendix N of the EIS). Of particular interest were those scientific and social studies carried out in the past few years that directly relate to either Yucca Mountain or to DOE actions such as the transportation of foreign research reactor spent nuclear fuel. DOE reevaluated the conclusions of previous literature reviews such as those conducted by the Nuclear Waste Technical Review Board and the State of Nevada, among others. DOE has concluded that:

- While in some instances risk perceptions could result in adverse impacts on portions of a local economy, there are no reliable methods whereby such impacts could be predicted with any degree of certainty
- Much of the uncertainty is irreducible, and
- Based on a qualitative analysis, adverse impacts from perceptions of risk would be unlikely or relatively small.

While stigmatization of southern Nevada can be envisioned under some scenarios, it is not inevitable or numerically predictable. Any such stigmatization would likely be an aftereffect of unpredictable future events, such as accidents, which would not be expected to occur. As a consequence, DOE addressed but did not attempt to quantify any potential for impacts from risk perceptions or stigma in this Final EIS.

8.8.1 (11010)
Comment - EIS001896 / 0008
Section 6.1.1 Impacts of Incident-Free Transportation

States that over 24 years of the proposed action, an estimated 18 latent cancer fatalities could occur in general populations along transportation route from radiation exposure under legal-weight truck scenario, and estimated 2 deaths under rail scenario. With the most heavily traveled routes being through urbanized areas in Southern Nevada and on congested highways, and the relatively slow speed of the trucks, there is a higher than normal potential for risk to our residents. Also, security and emergency response have not been adequately addressed.

Response
The transportation risk analysis in the EIS used state-specific truck and rail accident data from the U.S. Department of Transportation, supplemented by data obtained from the State of Nevada. In addition, the transportation analysis accounts for slower speeds by trucks in urban areas. The results of these analyses show that the risk to residents of Nevada would be low. Estimated radiological incident-free doses to individuals that might receive exposures, including truck crew members, inspectors, individuals stuck in traffic, and nearby residents are presented in Appendix J of the EIS. Appendix M contains an expanded discussion of security (see Section M.7) and emergency response (see Section M.5).

8.8.1 (11012)
Comment - EIS001896 / 0010
Section 10.1.2.5

The construction and operation of the rail and heavy-haul alternative will have adverse impacts on workers and the general public which are not addressed.

Response
DOE believes that Section 10.1.2.5 of the Draft EIS (Section 10.1.3 in the Final EIS) adequately summarizes the unavoidable adverse impacts of the heavy-haul truck and rail implementing alternatives within Nevada. In addition, this section references the sections of the EIS that describe estimated impacts.

8.8.1 (11424)
Comment - EIS002234 / 0008
Furthermore, the analysis in Appendix J appears to contain factual errors or misrepresentations. For example, it can be calculated from Table J-5 (page J-16) that 1,667 truck shipments from all four California commercial sites would take place during the 24-year operational period. However, when referring to Figure J-10 (page J-85) a small notation indicates that 6,250 truck shipments will enter Nevada on I-15 from California. Where do the extra 4,583 truck shipments come from? Likewise, it can be calculated from Table J-6 (page J-18) that 408 rail shipments from all four California commercial sites would take place during the 24-year operational period. However, when referring to Figure J-11 (page J-86) a small notation indicates that 1,837 rail shipments will enter Jean, Nevada from California. Where do the extra 1,429 rail shipments come from?

Response
Chapter 6 and Appendix J of the EIS contain substantial analyses related to the national transportation of spent nuclear fuel and high-level radioactive waste. However, in response to comments, considerable state-by-state information has been added to Appendix J, which now includes maps for each state, including Federally recognized Native American Reservations, showing routes used in the analyses for the EIS and tables listing rail and truck shipments estimated to originate in and pass through each state, and incident-free and accident risk impacts for each state (see Section J.4). These numbers should be considered tentative, as there are many factors that could cause the modes and routes to change including reactor operations, trading of pickup allocations, selection of a different transportation mode for shipments by the reactor operator, or recommendation of alternate routes by states. Impacts in individual states could be different if the actual routes from generator sites to Yucca Mountain were different from those analyzed. However, it is not likely that the total impacts from transportation would be changed significantly or that any particular route connecting an origin/designation pair present a significant difference in impacts from any other.

The number of shipments from generators in California identified in tables in Appendix J of the EIS are not the same as the number of shipments that would enter Nevada from California identified on figures in the appendix because shipments from generators in other states would also enter Nevada from California. For purposes of analysis in the EIS, DOE used methods described in Section J.1.1 to estimate routes shipments would use to transport spent nuclear fuel and high-level radioactive waste from commercial and DOE generator sites to a Yucca Mountain Repository. Using these methods, routes for rail and truck shipments used in the analyses included ones from generator sites that are not in California but that would enter Nevada from California either on the Union Pacific Railroad mainline or by legal-weight truck on Interstate-15.

An example of a generator site that would ship through California would be the Palo Verde Nuclear Plant in Arizona. In the mostly rail analysis scenario in the EIS, the calculated route for rail shipments from this site used Union Pacific mainlines. This route crosses the Arizona-California border near Yuma, Arizona, then travels to southeastern Nevada through San Bernardino and Barstow, California.

In the mostly legal-weight truck scenario, the route for shipments was calculated using rules in U.S. Department of Transportation regulations (see Sections M.2.4 and M.3.2.1.2 of the EIS). In this case, the required route under current regulations and following preferred routes currently designated by states and the Department of Transportation would be Interstate-10 from Arizona to San Bernardino, California, where it intersects with Interstate-215, Interstate-215 to Interstate-15, and Interstate-15 from California into Nevada.

Altogether, for the mostly rail scenario and a Jean branch rail line or Sloan/Jean heavy-haul truck route, the analysis in the EIS used rail routes from 13 generator sites outside California that would travel through the State. For the mostly legal-weight truck scenario, the analysis used routing that would travel through California for shipments from eight generators outside the State.

8.8.1 (11700)
Comment - EIS001597 / 0005
Obviously, if a spent nuclear fuel repository at Yucca Mountain is opened some time in the future, the number of shipments of spent fuel traversing Illinois will logically increase. But it seems to us that the frequency of shipments through Illinois appears to be skewed, and we wonder whether or not that skewing is not intentional. By skewing, we mean that they appear to be greater than they should be.

Response
In response to public comments, DOE has included maps of the highway routes and rail lines it used for analysis in Section J.4 of the EIS. Along with the maps the Department included potential health and safety impacts associated with shipments for each state through which shipments could pass, including Illinois.

8.8.1 (11752)
Comment - EIS001226 / 0009
I am concerned about environmental protection, safety, liability, disaster management, worker safety, incidental radiation exposure, property values. How will 30 years of nuclear waste shipments through Illinois impact the Chicago area, and what plans do you have for shipping accidents?

Response
The impacts of transportation are discussed in Chapter 6 and Appendix J of the EIS, which discuss issues such as those identified by the commenter.

In response to public comments, DOE has included maps of the highway routes and rail lines it used for analysis in Section J.4 of the EIS. Along with the maps, the Department included potential health and safety impacts associated with shipments for each state through which shipments could pass, including Illinois. The impacts in the Chicago area would be less than those for the State. Section M.5 discusses transportation emergency response.

8.8.1 (11824)
Comment - EIS001887 / 0389
In addition, the one hundred percent rail transportation scenario contained in the Draft EIS is impossible without substantial investments at reactor sites for infrastructure to accommodate large rail casks. Many reactor locations

cannot currently accommodate these types of transportation casks. Information as to which generator sites will require such upgrades is available. The Draft EIS should have evaluated the costs and impacts of such improvements.

Response
Section 2.1.3 of the EIS discusses the transportation scenarios. DOE believes that the mostly rail case, in which more than 95 percent of spent nuclear fuel and high-level radioactive waste would be shipped by rail, would most closely approximate the actual mix of truck and rail shipments. In reaching this conclusion, DOE has assessed the capabilities of the sites to handle larger (rail) casks, the distance to suitable railheads, and historic experience in actual shipments of nuclear fuel, waste, or other large reactor-related components. In addition, DOE considered relevant information published by sources such as the Nuclear Energy Institute and the State of Nevada. The mostly rail scenario would not require infrastructure improvements at commercial nuclear reactor sites.

Even if infrastructure improvements were required at some generator sites, the impacts and costs of such improvements are not in the scope of this EIS.

8.8.1 (12265)
Comment - EIS001888 / 0257
One of the primary reasons this examination is confined to truck analysis, is because the heavy rail casks assumed to be used in the DEIS do not exist at all. Several of the DEIS references were prepared assuming use of the Multiple Purpose Canister (MPC). The MPC was proposed by the DOE as a heavy transportation canister in 1994. It was later withdrawn after the preparation of an EIS. The reference documents cited to support the conclusions in the DEIS rely on the MPC canister for their conclusions. Therefore, the rail transportation scenario contained in the DEIS is almost entirely hypothetical. Past rail transportation experience, specifically data used in a risk assessment is wholly irrelevant to the proposed action.

Response
Section 2.1.3.4 of the EIS addresses shipping cask manufacture, maintenance, and disposal. In this section, DOE indicates that one or more qualified companies specializing in metal structures, tanks, and other heavy equipment would manufacture new shipping casks. Section 4.1.15.1 identifies five sites of component and/or full cask manufacturers in the United States (not to mention overseas capabilities) and the number of shipping casks needed for the truck and rail transportation program (Table 4-45). Additional detailed information is provided in the DOE report to Congress, *Plan for Transportation Cask Fabrication and the Deployment of Waste Acceptance Capabilities* (DIRS 156802-DOE 2001). In Appendix A of the plan, DOE provides three tables of existing casks and casks under development for truck transport, for rail transport, and for storage and transportation casks. The tables indicate that there are 14 truck casks built and three being fabricated, 6 rail casks built, and 11 dual-purpose casks built and nine being fabricated. A fourth table provides details of two U.S. manufacturers, indicating their capability to produce 20 casks per year after a 6-month lead-time.

The Nuclear Regulatory Commission has recently issued a 10 CFR Part 71 Certificate of Compliance for three transportation casks for rail transport. At present, one MP-187 and four HI-Star 100 casks have been produced. To date, no NAC-STC transportation casks have been produced. In addition, Transnuclear submitted a 10 CFR Part 71 application for its TN-68 rail cask in May 1999. Based on this demonstrated performance and capabilities, DOE believes the acquisition of adequate casks for the mostly rail scenario is reasonable.

8.8.1 (12302)
Comment - EIS001925 / 0004
Will the DOE agree not to ship the nuclear waste with other hazardous cargo?

Response
As described in Sections 6.1 and 6.2 of the EIS, spent nuclear and high-level radioactive waste shipped by trucks would be shipped with no other hazardous cargo present. Should spent nuclear fuel and high-level radioactive waste be shipped by trains, other hazardous cargo could be present. U.S. Department of Transportation regulations would prevent these other hazardous cargoes from being a hazard to the spent nuclear fuel and high-level radioactive waste, and the spent nuclear fuel and high-level radioactive waste would not be a hazard to these other cargoes.

8.8.1 (12361)
Comment - EIS002233 / 0002
We [San Bernardino County] border the southern portion of Nevada, and unfortunately, expect that high-level nuclear waste will be transported through this county as part of the proposal; and we are deeply concerned about potential significant consequences and impacts that an accident, sabotage, or other adverse events could have on our county. While the risk of an accident may be small, the result of even one accident could have enormous and grave consequences on the portion of the county where the accident occurred. We are not talking about an oil spill and fire. This would have long-term, wide-spread, devastating effects on our county.

If the Federal government cannot guarantee zero tolerance against the risk of accident in the transport of high-level radioactive waste across our county, then this project should not be approved and should not proceed.

We are deeply concerned that the EIS inadequately and only superficially evaluates the transporting of spent nuclear fuel and high-level nuclear waste to Yucca Mountain. The waste is controlled and supervised where it is currently located, as an example, in San Onofre. It will be controlled and supervised at Yucca Mountain. A good deal of that control and supervision is lost, however, once the fuel waste is placed in a truck or in a truck and a railroad car.

Hence, it is critical that extreme measures are taken to protect this high-level radioactive waste during transport across our county. And yet we find precious little evaluation of this risk in the EIS. It is only discussed in general terms. It gives us very little assurance that an accident during transport will not occur and how an accident will be mitigated, if it does occur.

The EIS is deficient in its current approach which fails to address the possible consequences of transportation over even plausible specific routes that are currently known or reasonably predictable. This type of evaluation is critical to local jurisdictions, such as our county, and should not be deferred until some uncertain future point in time.

The potential for release of high level radioactive materials through accidents or deliberate acts of sabotage are of grave concern to this county. The implications are far-reaching, and only minimally addressed in the EIS.

So we urge you, we implore you, to place this process on pause and undertake the needed detailed analysis of the transport of nuclear waste so that we can achieve a level of assurance that our homes, our schools, our churches, for that matter our whole living environment, is adequately protected in the years to come.

Response
The EIS acknowledges that transportation accidents can occur during the transport of radioactive materials to the proposed Yucca Mountain Repository. In Section J.1.4.2.3, the EIS estimates that there could be as many as 70 accidents under the mostly legal-weight truck shipping scenario and 8 accidents could occur under the mostly rail scenario. A study recently conducted by the Nuclear Regulatory Commission (DIRS 152476-Sprung et al. 2000) concluded that only a tiny fraction of all accidents, less than one in 10,000, would be severe enough to fail a spent nuclear fuel shipping cask. The reason for this is the rigorous design, performance, and testing requirements (see 10 CFR Part 71) for spent nuclear fuel and high-level radioactive waste shipping casks. Based on these statistics, DOE does not expect an accident to occur that would involve radiological consequences.

DOE acknowledges that all accidents cannot be prevented, even if unlimited funds and time are provided to complete an activity. However, assuring the safety of the public, workers, and the environment is the most important priority for the spent nuclear fuel and high-level radioactive waste shipping program. Many safety-related measures in addition to the use of accident-resistant Type B shipping casks would be employed to provide this assurance, including route selection to reduce risks, driver training, shipping cask and vehicle inspection and maintenance, emergency preparedness programs, prenotification requirements, preshipment planning, and others. In addition, safety incentives are included in the September 1998 Draft Request for Proposals for Waste Acceptance and Transportation Services (see Section M.3 of the EIS and *www.rw.doe.gov/wasteaccept/wasteaccept.htm*). Thus, while the risk of this or any other activity cannot be reduced to zero, DOE believes that adequate preventive, protective, and mitigative measures are or would be in place to ensure that the shipments pose no undue risks to the public, workers, and environment.

In terms of control and supervision, DOE is aware that spent nuclear fuel is better controlled at fixed locations, such as waste generator sites and the repository, than it is while being shipped. Access controls, guards, locked gates, and monitoring systems are examples of controls that are applied at fixed facilities to protect spent nuclear fuel. This is the main reason why special safeguards and security requirements (see 10 CFR Part 73) are applied to shipments of spent nuclear fuel to prevent their theft or diversion in transit. DOE would comply with all requirements of 10 CFR Part 73, including preshipment planning, communications, armed escorts, and tamper-indicating devices on shipping casks. In addition, a satellite tracking system such as the TRANSCOM system would be deployed to provide real-time tracking of the shipments and preshipment and in-transit communications. With all these controls in place, as well as the use of massive Type B containers that would provide considerable protection of spent nuclear fuel and high-level radioactive waste contents, DOE believes the shipments and the radioactive cargo would be adequately protected from theft, diversion, or acts of sabotage. See Section M.7 of the EIS for additional information on physical protection requirements.

The transportation impact analysis in the EIS is consistent with the requirements of the National Environmental Policy Act, Council on Environmental Quality guidelines, and DOE policies and guidance. It was also designed to provide the information necessary to support the decisions to be made based on the EIS. As stated on page S-2 of the Draft EIS Summary:

"DOE believes that the EIS provides the environmental impact information necessary to make certain broad transportation-related decisions, namely the choice of a national mode of transportation outside Nevada (mostly rail or mostly legal-weight truck), the choice among alternative transportation modes in Nevada (mostly rail, mostly legal-weight truck, or heavy-haul truck with use of an associated intermodal transfer station), and the choice among alternative rail corridors or heavy-haul truck routes with use of an associated intermodal transfer station in Nevada…Other transportation decisions, such as selection of a specific rail alignment within a corridor, would require additional field surveys, State and local government and Native American tribal consultations, environmental and engineering analyses, and appropriate National Environmental Policy Act reviews."

DOE believes that use of location-specific data and development of location-specific impact estimates such as the commenter suggests would not be practical or possible and would not materially affect the comparisons of alternatives and decisions to be made with regard to construction and operation of the proposed repository. Nevertheless, in response to comments on the Draft EIS, DOE has revised Appendix J of the EIS to include state maps of routes used in the analyses of impacts, the numbers of shipments in each state used in the analyses, and state-specific impact estimates.

8.8.1 (12369)
Comment - EIS010207 / 0001
The "Supplement to the Draft Environmental Impact Statement for a Geologic Repository...at Yucca Mountain" does not adequately address the hazards and problems of transporting nuclear wastes through populated areas to the Yucca Mountain site. Although St. Louis is centrally located for shipment of nuclear wastes, transporting irradiated fuel rods through downtown seems unsafe. On May 31, fourteen laden coal cars derailed and dumped their contents in a St. Louis suburb. Accidents happen. The accidental spilling of nuclear wastes could be lethal. Moreover, the plutonium and uranium are vulnerable to theft during transport.

Response
DOE issued the Supplement to the Draft EIS to provide updated information to the public. While aspects of the design have evolved from those in the Draft EIS, the basic elements of the Proposed Action to construct, operate and monitor, and eventually close a geologic repository at Yucca Mountain (such as transportation of spent nuclear fuel and high-level radioactive waste) remain unchanged. For this reason, the Supplement focused on the most recent design enhancements, including various operating modes to manage heat generated by emplaced spent nuclear fuel and high-level radioactive waste.

As discussed in Appendixes J and M of the EIS, most real-world accidents that have been postulated, including truck crashes into bridges, train derailments followed by fires, derailments followed by immersion of a cask into a river, and similar extreme accident conditions, would not be likely to result in release of radioactive materials from the shipping casks. Spent nuclear fuel casks are much more robust than the coal cars. If a spent nuclear fuel rail cask had been on the train that derailed and crashed into the river, the accident conditions would not have been more

severe than the design standards for the cask. No release of radioactive materials from the cask would have been expected. The performance standards for the casks prescribed by the Nuclear Regulatory Commission (see Section M.4) were selected to ensure that the chance that a real-world accident would result in loss of cask integrity and release of radioactivity from the cask is extremely remote. These standards ensure that the casks would be extremely robust.

Based on the revised analyses, DOE has concluded in the EIS that casks would continue to fully contain spent nuclear fuel in more than 99.99 percent of all accidents (of the thousands of shipments over the last 30 years, none has resulted in an injury due to release of radioactive materials). This means that there would be less than a 1-percent chance over 24 years of transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain by truck of an accident that could result in a release of radioactive material from a cask. The chance of a rail accident that would cause a release from a cask would be even less. The corresponding chance that such an accident would occur in any particular locale would be much less than 1 percent.

In the Draft EIS DOE considered six categories of increasingly severe and increasingly unlikely accident scenarios. The analyses hypothesized one accident scenario to represent each category, along with a corresponding projection of the amount of radioactive material that could be released from a transportation cask. The analyses estimated impacts of postulated releases in three population zones – urban, suburban, and rural – and under two weather conditions – slowly dispersing conditions, and moving-air conditions. The analyses also estimated the impacts from an unlikely but severe accident scenario called a maximum reasonably foreseeable accident. In response to public comments and to clarify this discussion for the reader, DOE has revised the EIS to describe the maximum reasonably foreseeable accident in terms of cask failure mechanisms, range of impact velocities, and temperature range for the accident.

The probabilities of the maximum reasonably foreseeable truck and rail accidents are stated in Sections 6.2.4.2.1 and 6.2.4.2.2 of the EIS. For the maximum reasonably foreseeable truck accident, the probability is about 2.4 in 10 million per year. For the maximum reasonably foreseeable rail accident, the probability is about 2.8 in 10 million per year. Radioactive materials are easily detected and there are proven methods for cleaning up spills and releases of radioactive materials. Like hazardous materials, any released radioactive materials would be cleaned up to existing standards in a reasonable length of time.

The Nuclear Regulatory Commission regulates the packaging and transportation related operations of its licensees, including establishing safeguards and security regulations to minimize the possibility of theft, diversion, or attack on shipments of spent nuclear fuel and special nuclear materials (10 CFR Part 73). DOE would comply with all requirements, including preshipment planning, communications, armed escorts, and tamper-indicating devices on shipping casks. Physical protection requirements are described in Section M.7 of the EIS.

8.8.1 (12577)
Comment - EIS001622 / 0016
Need for a Comprehensive transportation Analysis of Public Risks and Costs

The DEIS does not provide any meaningful quantitative transportation risk assessment, but instead refers to other agencies' regulatory authority. For example, DOE addresses transportation accident hazards by simply stating that transport of wastes will occur in accordance with U.S. Department of Transportation regulations.

Any analysis of transportation risks associated with shipping spent nuclear fuel is extremely sensitive to the assumptions made regarding, for example, routing, the amount of material shipped by rail versus truck, and the number of people along the routes and at various stops. The DEIS uses the "Modal Study" (NRC 1987) to predict very low probabilities of release of radioactive materials from a spent fuel cask under accident conditions. These analyses and risk analysis tools such as RADTRAN, although accepted by federal agencies for assessing transportation risks, have been criticized because of changing assumptions about cask capacity (new-generation casks will have much larger capacities), the radioactive characteristics of the spent fuel (radioactivity varies with fuel age and burn-up levels), the role human error may play in manufacturing quality control and operation of the casks, and the risk of sabotage or terrorist threat against a shipment.

In addition, tools such as RADTRAN incorporate critical assumptions about roadway geometrics and maintenance standards that require review if non-interstate routes are to be considered. The large projected increase in the numbers and operational complexity of spent fuel shipments to the proposed repository, in comparison with past shipments, may result in greater opportunities for human error in construction and operation of the spent fuel shipping casks. These factors should be taken into consideration in the DEIS' transportation risk assessment.

Further, the DEIS should provide a route-specific evaluation of the increased transport risk as the result of earthquakes, flooding, poor road conditions, and weather conditions. In addition, some routes leading to the Nevada Test Site/Yucca Mountain area are heavily traveled tourist and recreational routes. These routes can be greatly impacted by increased traffic. Increased truck traffic could influence the safety, reliability and congestion characteristics of these routes. The EIS should evaluate such potential impacts.

Recommendation: DOE should conduct a comprehensive risk analysis of routes and transport modes including public risks and costs to states, tribes and local communities to prepare for these shipments. When the proposed routes are identified in California, future EIS analyses should include a complete environmental review, including route-specific environmental analyses, in accordance with the requirements of the Clean Air Act, NEPA [National Environmental Policy Act], and the California Environmental Quality Act. This routing analysis of the primary and secondary routes should include structural and geometric road characteristics, emergency response capabilities along these routes, socio-economic impacts, wildlife, habitat, and public parts impacts, as well as risks to human populations along these routes. The DEIS should identify the significant fiscal impacts of emergency response preparation for these shipments and necessary road and rail improvements.

Response

DOE disagrees with the comment that the EIS does not provide a meaningful quantitative transportation risk assessment. Furthermore, DOE disagrees with the commenter's statement that transportation accident hazards are dismissed by referring to U.S. Department of Transportation regulations. Quantitative human health and safety impacts, as well as other environmental and socioeconomic impacts (for example, impacts on land use, water resources, biological resources, employment), for transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain are presented in Chapter 6 and Appendix J of the EIS. This included quantification of the radiological and nonradiological impacts of transportation accidents as well as the impacts of routine transportation. The transportation impact analysis in the EIS is consistent with the requirements of the National Environmental Policy Act, Council on Environmental Quality guidelines, and DOE policies and guidance. It was also designed to provide the quantitative information necessary to support the decisions to be made based on the EIS.

The transportation analysis in the EIS used state-of-the-art risk assessment tools and the currently available information that is reasonable to estimate the impacts of transporting spent nuclear fuel and high-level radioactive waste to the repository. For example, the computer programs used in the transportation analysis have been used extensively in other environmental impact statements and environmental assessments and have been evaluated to determine their validity for this purpose. The data used in the EIS to estimate transportation impacts are those that are available, reasonable, current, and adequate. In many instances special studies were conducted to collect additional data. For example, transportation accident and fatality rates were updated for the EIS in *State-Level Accident Rates of Surface Freight Transportation: A Reexamination* (DIRS 103455-Saricks and Tompkins 1999) and source terms from potential sabotage events were updated for the EIS in *Projected Source Terms for Potential Sabotage Events Related to Spent Nuclear Fuel Shipments* (DIRS 104918-Luna, Neuhauser, and Vigil 1999). The shipping cask performance data used to estimate the radiological risks of transporting spent nuclear fuel are from the Nuclear Regulatory Commission report *Reexamination of Spent Fuel Risk Estimates* (DIRS 152476-Sprung et al. 2000). These data represent the most recent, extensively researched available information on the performance of shipping casks during transportation accidents.

DOE recognizes that human errors cannot be totally eliminated during the fabrication and operation of shipping casks. Section J.1.4.2.1 of the EIS presents a discussion of the potential effects of human error, including undetected defects, on accident impacts. The shipping casks would be fabricated under Nuclear Regulatory Commission-approved quality assurance programs. As indicated in the GA4/9 shipping cask Certification of Compliance, each shipping cask would be extensively tested prior to its first use, including radiographic and ultrasonic inspections of welds, load testing of lifting trunnions, pressure testing of the cask containment boundary, gamma scans of the depleted uranium shield, and other tests. Trained and qualified personnel would conduct all

testing. The shipping casks would be subjected to periodic in-service testing and maintenance, such as seal replacement, visual inspections of seals and sealing surfaces, and leakage testing. In addition, all shipping cask handling, loading, unloading, testing, and maintenance operations would be conducted in accordance with detailed written procedures and by trained and qualified personnel. These testing, maintenance, procedural, and personnel training requirements would minimize the likelihood and consequences of human errors during cask fabrication and operation.

The shipping cask performance data used to estimate the impacts of a successful sabotage event are from *Projected Source Terms for Potential Sabotage Events Related to Spent Fuel Shipments* (DIRS 104918-Luna, Neuhauser, and Vigil 1999). This report estimated maximum releases of radioactive material from sabotage against a shipping cask containing spent nuclear fuel. The report considered 15 devices and chose two for detailed analyses. These data are reasonable, available, and appropriate information on the performance of shipping casks during a sabotage event.

Substantial amounts of site-specific data were used in the transportation analyses. For example, *Road Upgrades for Heavy Haul Truck Routes - Design Analysis* (DIRS 154448-CRWMS M&O 1998) includes tables of the speeds and times used for every section of highway for heavy-haul trucks for the entire route from the intermodal transfer station to the repository and it shows that travel speeds at intersections and in towns such as Tonopah and Goldfield, would be as low as 8 kilometers (5 miles) per hour. Based on public comments, the EIS now includes impacts representative of impacts in small communities along transportation routes. This analysis accounts for factors such as the locations of intersections, commercial establishments and residences, and traffic signals.

If data were unavailable, DOE made cautious yet reasonable assumptions to estimate impacts. These assumptions are discussed in Chapter 6 and Appendix J of the EIS, and in references for these sections. DOE is aware that there are uncertainties associated with the transportation impact results presented in the EIS. There are uncertainties associated with route characteristics, demographics, weather, atmospheric dispersion models, spent nuclear fuel characteristics, accident rates, release fractions, and many other elements of the risk assessments. Because one of DOE's goals is to choose between alternatives, the consistent consideration of uncertainty among alternatives means that the relative differences in impact estimates among alternatives should not be affected. To account for uncertainties in the data, conservative assumptions were made so the impacts reported in the EIS would consider the associated range of the potential impacts. However, DOE has chosen not to use assumptions that tend to overestimate in all cases, as this practice tends to produce unrealistic and improbable results. Consistent with Council on Environmental Quality regulations (40 CFR 1502.22), DOE is attempting to avoid compounding conservatisms, yielding unrealistic results, in analyzing environmental impacts. Such practices mask the real differences and would not produce suitable results to support choices among the alternatives. Thus, for example, DOE has chosen to use realistic waste characteristics information, accident rates, highway and rail distances between waste generators and the proposed repository, the number of people along the route and at stops, and shipping cask capacities. DOE believes that the impacts presented in the EIS are not so conservative that the true differences among alternatives are masked.

Section M.3 of the EIS includes a discussion of the protocols and procedures to be followed under adverse weather or road conditions and describes how safe parking areas are to be determined. The procedures are in two parts. One relates to pretrip planning that would use available data relating to expected conditions. Shipments would not be dispatched on a route where expected conditions would not comply with the requirements in the procedures. For in-route problems, it is expected that those with the shipment would best be able to discuss and report expected and encountered conditions. The transportation contractors are to develop detailed procedures for use by the drivers/crews in making determinations regarding adverse weather and road conditions. The procedure states that DOE would coordinate diversion to a safe area if delay was required.

With respect to the risk of transportation accidents from earthquakes, the frequency of such an event is below the 1×10^{-7} accidents per year that are considered by DOE to be reasonably foreseeable. This is because a series of events would need to occur simultaneously for a spent nuclear fuel shipment to become involved in an accident severe enough to fail the packaging system as a result of an earthquake. First, a relatively severe earthquake would need to occur. As a rule of thumb, an earthquake would not disturb drivers unless it is about Richter Magnitude 6 or greater (ground acceleration in excess of 0.1*g* or 0.1 times the acceleration due to gravity). This magnitude of earthquake is severe enough to cause extensive damage to buildings (depending on quality of construction) and cause chimneys to fall. Second, a spent nuclear fuel shipment would need to be close enough to the epicenter of the

earthquake to be affected. Third, the earthquake would need to be strong enough to cause the spent nuclear fuel or high-level radioactive waste shipment to become involved in a severe accident. A ground acceleration of 0.1*g* would not be severe enough, in general, to cause highway or bridge failures that could lead to a severe accident. However, it would be noticeable to a truck driver and could cause the driver to swerve or engage in an unsafe action. Most likely, this magnitude of earthquake would cause drivers to pull over and await further instruction. Finally, the accident would need to be severe enough to cause functional failure of the shipping cask. As discussed in the EIS, spent nuclear fuel and high-level radioactive waste would be shipped in extremely accident-resistant shipping casks. Even under severe accidents, the shipping cask would be likely to remain intact and retain its radioactive cargo. As a result, DOE has concluded that the frequencies of transportation accidents initiated by earthquakes are not reasonably foreseeable and, thus, are not required by the National Environmental Policy Act to be analyzed in the EIS.

The commenter requested additional information on emergency response provisions. Two regulations address the concern. First, NWPA Section 180(c) requires DOE to provide funds for training emergency response personnel in eligible jurisdictions along selected transportation routes. These requirements are discussed in detail in Sections M.5 and M.6 of the EIS. Second, there is a Federal Radiological Program outlined in the Federal Radiological Emergency Response Plan and the Federal Radiological Monitoring and Assessment Plan. These plans outline the policies, procedures, roles, and responsibilities of Federal, tribal, state, and local agencies in planning for and responding to emergencies involving releases or suspected releases of radiological materials from government and commercial facilities or operations. Under Section 180(c), DOE will fund eligible jurisdiction planning activities to determine current capabilities and needs and fund training for emergency response activities.

With regard to road and rail improvements outside Nevada, the shipment of radioactive materials requires no special transportation infrastructure that is not necessary for safe transport of commodities in the United States today. The U.S. Department of Transportation is the regulatory agency responsible for establishing and enforcing the standards for the transportation infrastructure. Adequate highways, rail lines, crossings, bridges, and tunnels exist to support the transportation of materials described in the EIS. In Nevada, upgrades to roads for heavy-haul truck shipments and the construction of a branch rail line to the repository are discussed in Chapter 6 and Appendix J of the EIS.

8.8.1 (12694)
Comment - EIS001898 / 0006
In the absence of a preferred route and mode of transportation, it is unclear whether the non-radiological impacts related to transportation of SNF [spent nuclear fuel] and HLW [high-level radioactive waste] within Nevada, including impacts from construction and operation of intermodal transfer stations and rail lines, have been bounded.

Basis:

The DEIS identifies the transportation of SNF and HLW as one of the components necessary for a repository. As such, transportation is a connected action (40 CFR 1508.25(a)(1)) and should be considered an integral part of the Yucca Mountain project. The NRC [Nuclear Regulatory Commission] understands that DOE would like to benefit from public input, through comments on the DEIS, when considering preferred transportation modes and routes. However, an integrated impact assessment that connects transportation to disposal needs to be included as part of any evaluation of the Proposed Action in the FEIS.

The current analysis for transportation within Nevada provides a general discussion of impacts, but does not fully assess the non-radiological impacts. Further, it is not apparent that the transportation analysis in the DEIS bounds the non-radiological impacts (e.g., socioeconomic impacts and impacts to air quality, cultural and biological resources, and land and water use). Moreover, although DOE has identified a number of options, it has not clearly defined which options (e.g., rail line construction, mode of transportation, need for intermodal transfer stations, preferred routing within Nevada, and type of trucks) it will use to support the Proposed Action.

As noted in Comment 1, the FEIS should show that, once decisions on transportation routes and modes are made, no new information or circumstances exist that could result in significant changes to the impacts assessed in the FEIS.

Recommendation:

Transportation impacts (including non-radiological and cumulative impacts) should be discussed in sufficient detail to support selection of a Proposed Action. The FEIS should contain either a complete, integrated assessment of the connected transportation actions or sufficient information and analyses on the various options to show that the impacts of the Proposed Action have been bounded.

Response

DOE believes that the EIS adequately analyzes the environmental impacts that could result from the Proposed Action. This belief is based on the level of information and analysis, the analytical methods and approaches used to represent conservatively the reasonably foreseeable impacts, and the use of bounding assumptions where information is incomplete or unavailable, or where uncertainties exist. The use of widely accepted analytical tools, latest reasonably available information, and cautious but reasonable assumptions offer the most appropriate means to arrive at conservative estimates of transportation-related impacts.

For the reasons discussed above, DOE believes that the EIS provides the environmental impact information necessary to make certain broad transportation-related decisions, namely the choice of a national mode of transportation outside Nevada (mostly rail or mostly legal-weight truck), the choice among alternative transportation modes in Nevada (mostly rail, mostly legal-weight truck, or heavy-haul truck with use of an associated intermodal transfer station), and the choice among alternative rail corridors or heavy-haul truck routes with use of an associated intermodal transfer station in Nevada. DOE has identified mostly rail as its preferred mode of transportation, both nationally and in Nevada. At this time, however, the Department has not identified a preference among the five candidate rail corridors in Nevada.

If the Yucca Mountain site was approved, DOE would issue at some future date, a Record of Decision to select a mode of transportation. If, for example, mostly rail was selected (both nationally and in Nevada), DOE would identify a preference for one of the rail corridors in consultation with affected stakeholders, particularly the State of Nevada. In this example, DOE would announce a preferred corridor in the *Federal Register* and other media. No sooner than 30 days after the announcement of a preference, DOE would publish its selection of a rail corridor in a Record of Decision. A similar process would occur in the event that DOE selected heavy-haul truck as its mode of transportation in Nevada. Other transportation decisions, such as the selection of a specific rail alignment within a corridor, would require additional field surveys, State and local government and Native American tribal consultations, environmental and engineering analyses, and appropriate National Environmental Policy Act reviews.

In this EIS, DOE has used computer models it has used in previous EISs and other studies. These models are widely accepted by the national and international scientific and regulatory communities. For instance, DOE selected the RADTRAN 5 computer program to estimate radiological impacts to populations from incident-free transportation and from accidents. RADTRAN, which was originally developed by Sandia National Laboratories in the late 1970s, has been used in many other previous DOE EISs, and it has undergone periodic review and revision. In 1995, an independent validation review of RADTRAN 4 (immediate predecessor to RADTRAN 5) demonstrated that it yielded acceptable results when compared to "hand" calculations. More recently, an independent review found that RADTRAN 5 overestimates the measured radiation dose to an individual from moving radiation sources.

To ensure that the EIS analyses reflect the best latest reasonably available information, DOE has either incorporated information that has become available since the publication of the Draft EIS or modified existing information to accommodate conditions likely to be encountered over the life of the Proposed Action. For example, the analysis in the Draft EIS relies on population information from the 1990 Census. In this Final EIS, DOE has scaled impacts upward to reflect the relative state-by-state population growth to 2035, using 2000 Census data.

Although the EIS analyses are based on the best latest reasonably available information and state-of-the-art analytical tools, not all aspects of incident-free transportation or accident conditions can be known with absolute certainty. In such instances, DOE has relied on conservative assumptions that tend to overestimate impacts. For instance, DOE assumed that the radiation dose external to each vehicle carrying a cask during routine transportation would be the maximum allowed by U.S. Department of Transportation regulations. Similarly, DOE assumed that an individual, the "maximally exposed individual," would be a resident living 30 meters (100 feet) from a point where all truck shipments, or 200 meters (660 feet) from a point where all rail shipments would pass. Under these

circumstances, the maximally exposed individual would receive a dose of about 6 millirem from exposure to all truck shipments, and a dose of about 2 millirem from exposure to all rail shipments (6 millirem represents an increased probability of contracting a fatal cancer of 3 in 1 million). Although it can be argued that individuals could live closer to these shipments, it is highly unlikely that an individual would be exposed to all shipments over the 24-year period of shipments to the repository, even though DOE incorporated this highly conservative assumption in the analysis.

8.8.2 NEVADA GENERAL

8.8.2 (121)
Comment - 4 comments summarized
Commenters stated that the EIS did not consider scoping comments, advice, and reference documents submitted to DOE from affected counties and State agencies in Nevada. As a consequence, the EIS ignores a host of important community issues that would reasonably be expected to be considered in a project of this scope and significance. Another commenter said that the information necessary to make an accurate assessment of the impacts to Nevada from spent nuclear fuel and high-level radioactive waste transport is available, not exorbitant to gather, and should be obtained and included in the EIS prior to any agency decision, as required by the National Environmental Policy Act.

Response
In analyzing potential impacts of transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain, DOE evaluated the potential for impacts in Nevada and counties within the region of influence in multiple environmental resource areas considered in the environmental impact analyses. These resource areas, described in Section 6.3 of the EIS, include land use; air quality; hydrology; biological resources and soils; cultural resources; human health and safety; socioeconomics; aesthetics; noise; waste management; utilities, energy, and materials; and environmental justice.

To analyze the potential for impacts that could affect environmental resources, DOE collected and considered large amounts of information, including information provided by the State of Nevada and counties in the State. For the analyses, DOE used information that it judged to be relevant and reasonable. For example, based on comments submitted during scoping hearings for the EIS, DOE added consideration of the Caliente-Chalk Mountain Corridor and Caliente/Chalk Mountain heavy-haul truck route. In response to public comments on the Draft EIS, DOE used projections of population growth in Nevada provided by Clark and Nye Counties and the Nevada State Demographer for updated information presented in the Final EIS. DOE reviewed many documents produced by Lincoln County and other county and State agencies. The transportation-related information contained in those documents was considered for inclusion in the EIS. Nevada highway traffic information was collected from the Nevada Department of Transportation (DIRS 103405-NDOT 1997). DOE obtained and used accident rates for Nevada highways from the Department of Motor Vehicles and Public Safety, State of Nevada (see Section J.1.4.2.3 of the EIS). DOE used information contained in a report prepared for the City of North Las Vegas (DIRS 155112-Berger Group 2000). The information in that report provided DOE with an estimate of the cost of advancing completion of the Las Vegas Beltway for use by heavy-haul trucks, an estimate of the populations that could live along the Beltway, and a basis for estimating the dose to a maximally exposed individual in a Nevada community from transportation of spent nuclear fuel and high-level radioactive waste to Yucca Mountain. DOE also used information in *Statewide Radioactive Materials Transportation Plan, Phase II* to identify candidate alternative highway routes for shipments of spent nuclear fuel and high-level radioactive waste that the State of Nevada has considered in the past (DIRS 103072-Ardila Coulson 1989).

DOE does not believe it necessary to consider population characteristics on a community-by-community basis to determine potential public health and safety impacts from the transportation of spent nuclear fuel and high-level radioactive waste. The use of widely accepted analytical tools, latest reasonably available information, and cautious but reasonable assumptions if there are uncertainties, offer the most appropriate means to arrive at conservative estimates of transportation-related impacts.

8.8.2 (135)
Comment - 18 comments summarized
Several commenters identified the economic and multi-use benefits of sharing a branch rail line. The commenters stated that rail routes could enhance access to mining and mineral resource areas. One commenter offered specific considerations for the placement of a rail line near Pahrump to the west near the Von Schmidt survey line. The commenter contended this location would offer safety, aesthetic advantages, and multiple-use transportation benefits. Several commenters asked about ownership of the tracks and rights-of-way, and the final disposition of the branch rail line. Other commenters expressed concern about shared use negatively affecting the safety and environmental risk of transportation. Commenters remarked that because shared use was not specifically addressed, the true impacts of such situations are not known and decisions cannot be made. One commenter stated that the Draft EIS was a legally insufficient assessment of rail transportation risks and impacts because it provided incomplete and contradictory information on rail operating assumptions and failed to address the safety and environmental implications of potential shared use of the rail line for shipments of commercial explosives, military weapons and munitions, petroleum products, and other hazardous materials.

Response
If the Yucca Mountain site was approved, DOE believes that the EIS provides the environmental impact information necessary to make certain broad transportation-related decisions, namely the choice of a national mode of transportation outside Nevada (mostly rail or mostly legal-weight truck), the choice among alternative transportation modes in Nevada (mostly rail, mostly legal-weight truck, or heavy-haul truck with use of an associated intermodal transfer station), and the choice among alternative rail corridors or heavy-haul truck routes with use of an associated intermodal transfer station in Nevada. However, follow-on implementing decisions, such as the selection of a specific rail alignment in a corridor, would require additional field surveys, State and local government and Native American tribal consultations, environmental and engineering analyses, and appropriate National Environmental Policy Act reviews.

DOE identified the potential for shared use in Section 8.4.2 of the EIS as a reasonably foreseeable future action. This section states "DOE would have to consider these impacts [of shared use] in any decision it made to allow shared use of the branch rail line." If the Yucca Mountain site was approved, then decisions regarding ownership and shared use would be made. Line ownership, however, would not affect potential environmental impacts.

Regarding rail corridor alignments different from those identified in the EIS, as discussed in Sections 6.3.2 and J.3.1.2 of the EIS, DOE has narrowed its consideration for a branch rail line to five candidate rail corridors through a process of screening rail alignments it has studied. The sections identify six earlier studies. For example, in the *Nevada Potential Repository Preliminary Transportation Strategy, Study 2, February 1996*, the Department evaluated a rail alternative called the Stewart Valley Alternate (DIRS 101214-CRWMS M&O 1996). This corridor alignment west of Pahrump was removed from further consideration because of the greater potential for land-use conflicts than in the corridors evaluated in the EIS. Chapter 4 of that report discusses potential operations of a branch rail line. Because use of the branch rail line to transport materials to Yucca Mountain would continue until 2034 under the Proposed Action, it would be premature at this time for the Department to make a decision on the use or disposition of the branch rail line after emplacement operations were completed.

Impacts, including impacts to human health and safety, biological resources, land use, aesthetics, and multiple other resource areas, of constructing and using a branch rail line for transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain are discussed in Section 6.3.2 of the EIS. In response to public comments, DOE has enhanced and clarified its analyses and discussions of these impacts. The Department's *Rail Alignment Analysis* provides evaluations of branch rail lines in each of the five candidate rail corridors (DIRS 131242-CRWMS M&O 1997). The evaluations are based on requirements and standards contained in the American Railway Engineering Association and U.S. Department of Transportation regulations and Federal Railroad Administration Track Safety Standards. Included are standards for railroad crossings over highways.

8.8.2 (179)
Comment - 3 comments summarized
Commenters said that the EIS should discuss past and current impacts to Nevada residents from the transportation of radiological materials and hazardous materials along the candidate routes for spent nuclear fuel and high-level

radioactive waste shipments to Yucca Mountain. By so doing, the EIS can then determine the cumulative impacts to populations in Nevada who have been repeatedly exposed to these materials.

Response
Section 8.4.1.2 of the EIS presents the cumulative impacts of radioactive material transportation in the United States since 1943. These cumulative impacts include the impacts of historic DOE shipments, which include shipments associated with the Nevada Test Site (see Table 8-58). Table 8-58 lists the impacts for the expanded use of the Nevada Test Site. Even if all the impacts from historic DOE shipments were allocated to Nevada, the impacts would be extremely small, about a 0.1 chance of a latent cancer fatality among members of the affected population.

Section 8.4.2.7 of the EIS describes the Nevada transportation impacts and states that the estimated total collective worker dose from the entire DOE low-level radioactive waste intermodal shipping campaign, including transportation impacts, would be about 4.2 person-rem. The population dose associated with low-level radioactive waste shipments by truck would be about 7.6 person-rem for the entire shipping campaign. These impacts are extremely small, less than about a 0.01 chance of a single latent cancer fatality among members of the affected population.

8.8.2 (188)
Comment - 2 comments summarized
Commenters stated that the proposed repository raises a number of concerns for the citizens of Nye County. These include a number of transportation issues. The national transportation network shown in the Draft EIS points to the fact that shipment of spent nuclear fuel and high-level radioactive waste by truck, rail, or intermodal routes would funnel all of the shipments through Nye County. The United States must take all steps necessary to ensure safe transport methods are implemented, that Nye County residents are not subjected to additional risk, whether radiological or safety related, and Nye County be given the capability to respond to any accidents within its jurisdiction.

The transportation analysis and Draft EIS fails to consider the safety hazards along specific routes. Furthermore, by not including the mitigation measure required to safely use these roads for such a shipping campaign, DOE has failed to inform the decisionmakers of the implications of impacts that would accompany repository operations.

Response
As discussed in the EIS, accidents involving spent nuclear fuel or high-level radioactive waste shipments could occur. However, of the approximately 53,000 truck shipments, there would be an estimated 66 accidents, each having less than a 0.01-percent chance that radioactive materials would be released. The chance of a rail accident that would cause a release from a cask would be even less. Of the thousands of shipments completed in the United States over the last 30 years, none has resulted in an injury through the release of radioactive materials.

Regardless, in response to comments, DOE has revised the EIS by adding Appendix M to provide information on DOE funding for improvements in emergency response training and capabilities along the routes (see Section M.5 of the EIS). State and tribal governments have primary responsibility to respond to and to protect the public health and safety in their jurisdictions from accidents involving radioactive materials. Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for training of public safety officials of appropriate units of local government and tribes through whose jurisdictions it would transport spent nuclear fuel and high-level radioactive waste. In 1998, DOE published a Notice of Revised Proposed Policy and Procedures in the *Federal Register* (63 *FR* 23753; April 30, 1998) that sets forth the proposed mechanisms for implementing the requirements of Section 180(c). As part of this program, about 4 years prior to the first shipments, eligible jurisdictions would receive a one-time planning grant to assess their training needs. In accordance with the Section 180(c) Policy and Procedures, jurisdictions could use a certain percentage of their financial assistance to purchase appropriate (for example, training-related) equipment that can be used for training, inspections, and emergency response. This could include the detection equipment mentioned in the comment. See Section M.6 for a detailed discussion of the Section 180(c) provisions and emergency response programs. If requested, DOE and other Federal agencies can assist in responding to an incident.

DOE has several programs available to provide assistance to state, tribal, and local governments in response to radioactive material accidents. The Radiological Assistance Program, for example, provides trained personnel with

equipment to evaluate, assess, advise, and assist in the mitigation and monitoring of potential immediate hazards associated with a transportation accident. As part of the program, DOE maintains eight Regional Coordinating Offices across the country that are staffed 24 hours a day, 365 days a year. The staff consists of nuclear engineers, health physicists, industrial hygienists, public affairs specialists, and other personnel who provide field monitoring, sampling, decontamination, communications, and other services, as requested. In addition, DOE's Radiation Emergency Assistance Center/Training Site (REAC/TS) focuses on providing rapid medical attention to people involved in radiation accidents. REAC/TS maintains a 24-hour response center to provide direct support, including deployable equipment and personnel trained and experienced in the treatment of radiation exposure, to assist Federal, state, tribal, and local organizations.

DOE believes that the EIS adequately analyzes transportation-related impacts that could result from the Proposed Action. DOE also believes that the EIS provides the information necessary to make decisions on the basic approaches to transporting spent nuclear fuel and high-level radioactive waste (either rail or truck shipments), as well as the choice among alternative rail corridors in Nevada, if the site was recommended and approved. See the introduction to Chapter 8 of this Comment-Response Document for more information.

8.8.2 (419)
Comment - EIS000071 / 0017
Again, DOE has placed their federal emission requirements over the health and safety concerns of the citizens of Nye County.

Response
DOE believes that there is a transcription error in this comment and that "emission" should be "mission." The Yucca Mountain Project Manager, Russell Dyer, in testimony before the Nevada Senate Transportation Committee on March 22, 2001, stated, "I want to reaffirm that protection of public health and safety is our foremost objective for a potential repository and related transportation system. We remain committed to completing our ongoing scientific and technical evaluation before determining whether to recommend approval of Yucca Mountain to the President." He further stated, "We are committed to safe transportation of radioactive materials within Nevada and throughout the country, whether by highway or rail and have demonstrated our ability to work cooperatively with state authorities in conducting the Department's transportation of radioactive material."

8.8.2 (1170)
Comment - EIS000229 / 0003
The DEIS discussion of HHT [heavy-haul truck] safety issues is also deficient. Because of the lack of actual experience with long distance HHT shipments, no meaningful empirical data is available to support the DEIS assertion that accidents risks "are low for all five [route] alternatives." [p.6-96] HHT operations on the routes identified in the DEIS may experience substantially higher accidents frequencies and consequences. For example, using Nevada average accident rates, and projected shipment-miles for DOE's Module 2 scenario, the expected number of HHT accidents on the Caliente route would be about 24 (12 loaded, 12 empty) over 39 years. The severity and consequences of accidents could be greater because of unique local hazards. Steep upgrades and downgrades (especially in combination with horizontal curves less than 800 feet radius) and critical side slopes and steep drop-offs (common near the summits of mountain passes) could subject casks to extreme accident impact forces and make emergency response, cask recovery, and post-accident cleanup difficult. Such conditions appear to exist near Oak Springs Summit on US 93, near Hancock Summit on SR 375, and at several other locations along the Caliente HHT route.

Response
Heavy-haul truck impacts were calculated using the Primary road rates in Saricks and Tompkins (DIRS 103455-1999). Although the document does not explicitly address heavy-haul truck accident rates, DOE believes this document provides the best available consistent data set for the impact analyses. The accident rates used in the analysis were conservative because of the special precautions taken by heavy-haul truck shipments to prevent accidents, such as restricting travel to daylight hours and providing escort vehicles in front of and behind the trucks. The heavy-haul trucks could affect the accident rates for other vehicles. However, the additional precautions described above in addition to the planned road improvements would mitigate these effects. As a result, DOE believes the analysis of heavy-haul truck accident frequencies is adequate for its intended purpose.

The commenter expressed concern that the severity and consequences could be greater because of unique local hazards. In the analysis of accidents, these events are termed "initiating events." A large number of specific initiating events can be identified by review of historic transportation accidents or by the imagination. These include collisions with fixed objects (bridge abutments, walls, barriers, etc.), collisions with other vehicles and animals, rollovers, jackknifes, derailments, and collisions at grade crossings. Any initiating event can be characterized in terms of its mechanical forces and heat, and the event can then be categorized according to the matrix shown in Figure J-8, which is the transportation accident risk model used in the EIS. This model was taken from Sprung et al. (DIRS 152476-2000). As a consequence, it is not necessary to analyze every possible initiating event individually because the range of accidents included in the report encompasses all credible initiating events.

Regardless of the specific initiating event and type or transport vehicle, the severity of a transportation accident can be characterized by the combination of mechanical forces and heat involved in the accident and imposed on the cask. Mechanical forces account for the severity of the crash itself, while heat accounts for the severity of fire that could be involved in the accident. The Nuclear Regulatory Commission report concluded that only a tiny fraction of all accidents, less than one in 10,000, would be severe enough to fail a spent nuclear fuel shipping cask (DIRS 152476-Sprung et al. 2000). The reason for this is the rigorous design, performance, and testing requirements (see 10 CFR Part 71) for spent nuclear fuel and high-level radioactive waste shipping casks. This study reaffirmed that the spent nuclear fuel transportation regulations provide adequate protection of public health and safety. The report is an update of the accident risk model used in the Draft EIS that was referred to as the Modal Study (DIRS 101828-Fischer et al. 1987).

8.8.2 (1796)
Comment - EIS000616 / 0003
And the last thing I would like to say is I tried to find a more detailed map on exactly where the railroads go, particularly Lander County, and that wasn't available.

Response
Appendix J of the EIS refers to the *Nevada Potential Repository Preliminary Transportation Strategy, Study 1* (DIRS 104795-CRWMS M&O 1995) and the *Nevada Potential Repository Preliminary Transportation Strategy, Study 2* (DIRS 101214-CRWMS M&O 1996), among others, which provide information on the rail corridor alignment including detailed maps. Detailed maps of the alternative routes are included in Appendix J.

8.8.2 (3067)
Comment - EIS000619 / 0008
Another area where the draft is deficient is in its treatment of existing rail and highway within Nevada. For example, from West Wendover to Beowawe, the interstate and Union Pacific rail line go through several communities and cross the Humboldt several times, and you would never know that from reading the draft.

Response
The portions of routes that use existing rail and highways within Nevada were analyzed for each of the transportation implementing alternatives in Nevada as part of the national transportation analysis discussed in Sections 6.2.3.1 and 6.2 3.2 of the EIS. The range of impacts associated with this analysis can be found in Tables 6-8 and 6-9 for legal-weight trucks and Tables 6-11 and 6-12 for railroads. Maps of the representative national routes analyzed are given in Figures 6-11 and 6-12. In addition to analyzing the impacts of using routes that would meet U.S. Department of Transportation requirements for transporting spent nuclear fuel, DOE evaluated how the estimated impacts would differ if legal-weight trucks or railroads used other routes in Nevada in Section J.3.1. This section describes alternate routes and alignments within Nevada, identifies differences in lengths and population distributions, lists potential infrastructure upgrade needs, and assesses the impacts to individuals and populations along each of these routes. Comparisons of impacts based on populations along specific highways in Nevada are provided in Table J-48. Both the rail and highway transportation analyses have taken into account the population of the communities along the routes and the estimated accident characteristics of the given routes. Specific incident rates for Nevada routes were provided by the State and used in the analyses.

8.8.2 (4125)
Comment - EIS001458 / 0002
DOE could improve its transportation analysis by including a strong statement in the final environmental impact statement regarding the inherent safety of used fuel transportation and robust packages used to transport nuclear fuel and high-level radioactive waste. DOE should also put the risks associated with spent fuel transportation in perspective such that it's evident to members of the public and policy makers and clearly identifies that transportation risks associated with the proposed action are small.

Response
The results presented in the EIS demonstrate that the impacts of transporting spent nuclear fuel and high-level radioactive waste would be low, in large part due to the use of robust packaging. The EIS attempts to place these risks in perspective in the Summary and in Chapter 6 of the EIS. A discussion of cask safety and testing and operational protocols designed to enhance safety has been added in Appendix M.

8.8.2 (4168)
Comment - EIS000544 / 0002
As far as the infrastructure impacts are concerned, we found no inventory of locations that need remedial activity within the DEIS. There were no calculations to determine these costs. No comparisons of the benefit costs for rail as opposed to heavy-haul. And pretty much that the verbiage around heavy-haul assumes that this is something that our highway system now can sustain.

There's been a plethora of media coverage about the autoclave deliveries that we have had and these vehicle configurations to haul these amounts into our state. There's been an assumption that our heavy-haul casks, heavy-haul operations would be somewhat like that.

And the public should really realize that we only really permit about one of those vehicles a year and that we're looking at something on the neighborhood of two loaded vehicles a day going into the site and then two unloaded vehicles that are only 200,000 pounds of less weight going out of the site back to the intermodal facility. It's not a campaign that is run smoothly or efficiently, I guess is the word I can use.

Lastly, as far as the operations considerations of heavy-haul, we found absolutely no estimate of what traffic queues would be accumulated behind these convoys.

Response
Section J.3.1.2 of the EIS addresses the routes in Nevada for transporting rail casks, including heavy-haul trucks and railroads. Additional details of the rail and heavy-haul truck system infrastructure requirements and assumptions used to establish their preliminary designs are included in the EIS references listed in Section 12 as *Transportation Engineering File: Road Upgrades for Heavy Haul Truck Routes–Design Analysis* (DIRS 154448-CRWMS M&O 1998), and *Rail Alignment Analysis* (DIRS 131242-CRWMS M&O 1997). These analyses contain plan and profile drawings of the five rail corridors, and rail alignment maps showing land usage with respect to the location of the rail corridor.

Sections 6.3.3.1 and 6.3.2.1 of the EIS contain cost ranges of the five rail corridors and heavy-haul truck routes with a life-cycle cost for rail ranging from $283 million to $880 million, and for heavy haul truck life-cycle costs ranging from $387 million to $669 million. Detailed costs associated with these systems are included in *Cost Estimate for Heavy Haul Truck Transport Design* (DIRS 154675-Ahmer 1998) and *Nevada Transportation Study Construction Cost Estimate* (DIRS 154822-CRWMS M&O 1998).

DOE has identified mostly rail as its preferred mode of transportation, both nationally and in Nevada. However, should heavy-haul truck transport be selected as the preferred mode, detailed engineering and environmental studies, including dynamic traffic analysis, would be performed on the selected road route. A detailed dynamic traffic analysis would identify potential traffic queues for each route section. The road upgrades listed in Section J.3.1.2 of the EIS that have been proposed would then be modified to minimize traffic impacts. A specific cost/benefit analysis of the two scenarios, rail versus heavy-haul truck, has not been performed and is generally not necessary to support current decisionmaking.

8.8.2 (4286)
Comment - EIS001160 / 0094
Page 3-99, Section 3.2.2 address legal weight truck shipments on U.S. Highway 95. Does failure of the DEIS imply that legal weight shipments would not be allowed on other routes without supplemental NEPA [National Environmental Policy Act] documentation? The DEIS should indicate what, if any, supplemental NEPA documentation would be required for a route other than those assessed within the DEIS.

Page 3-99, Section 3.2.2 implies that only data for U.S. Highway 95 was used in the analysis. If this is the case, the analysis may not accurately represent risks of shipping fuel on other Nevada highways. Nevada's highways are characterized by unique traffic patterns, load levels, seasonal environmental conditions and physiography.

Response
The routes chosen for analysis for the legal-weight truck case were selected based on U.S. Department of Transportation rules for routing shipments of spent nuclear fuel. Briefly stated, these rules require shipments to use Interstate System highways wherever possible. When it is necessary to leave the Interstate Highway System, the rules require using the shortest route to the destination. Thus, the EIS analyzed Interstate-15 and then U.S. 95 to the repository. Additional information on route selection can be found in Appendix M of the EIS. If a state wishes, it can designate alternate routes using Federal guidelines. Nevada has not done so. If the State was to designate alternate routes, which would include conducting a safety analysis, DOE would follow those routes.

In addition to analyzing the impacts of using highway routes that would meet U.S. Department of Transportation requirements for transporting spent nuclear fuel, DOE evaluated how the estimated impacts would differ if legal-weight trucks used other routes in Nevada. Six other routes identified in a 1989 study by the Nevada Department of Transportation were used in the analysis. A discussion of this analysis can be found in Section J.3.1.3 of the EIS.

8.8.2 (4300)
Comment - EIS001160 / 0109
Page 6-38, Section 6.3.1. Although proposed shipments using legal weight trucks would represent only a fraction (about 1 percent) of total truck traffic on Nevada highways, because of the nature of the material shipped, the impact on such things as socioeconomics, aesthetics and perception by the public could be significant. The relationship to regular commercial traffic is only applicable in the amount of fossil fuels burned and related impacts. Truck volume and other impact experiences from transport of spent fuel and other nuclear and hazardous wastes should be used to determine impacts of transportation.

Response
As described in Section 6.3 of the EIS, DOE's analysis of impacts from legal-weight trucks on Nevada highways does include socioeconomics and aesthetics. The topics considered for socioeconomics include changes in employment, personal income, populations, Gross Regional Product, and state and local government expenditures. The region of influence for the analysis included Clark, Lincoln, and Nye Counties. The other Nevada counties were included collectively. The topics considered for aesthetics included visual sensitivity of view-sheds, ratings for scenery, and ratings for adjacent land use. The regions of influence included landscapes along candidate rail corridors and highway routes and near possible intermodal facilities, and aesthetics qualities that construction and operations could affect. The ratings were based on the Bureau of Land Management Visual Resource Management System.

Truck volumes are considered based on analyses provided in Section J.1.2 of the EIS. Impact experience for Nevada was considered based on incident rates provided by the State, as discussed in Section J.1.4.2.

In light of the comments received on the Draft EIS concerning perceived risk, DOE examined relevant studies and literature on perceived risk and stigmatization of communities to determine whether the state-of-the-science in predicting future behavior based on perceptions had advanced sufficiently since scoping to allow DOE to quantify the impact of public risk perception on economic development or property values in potentially affected communities (see Section 2.5.4 and Appendix N of the EIS). Of particular interest were those scientific and social studies carried out in the past few years that directly relate to either Yucca Mountain or to DOE actions such as the transportation of foreign research reactor spent nuclear fuel. DOE reevaluated the conclusions of previous literature

reviews such as those conducted by the Nuclear Waste Technical Review Board and the State of Nevada, among others. DOE has concluded that:

- While in some instances risk perceptions could result in adverse impacts on portions of a local economy, there are no reliable methods whereby such impacts could be predicted with any degree of certainty
- Much of the uncertainty is irreducible, and
- Based on a qualitative analysis, adverse impacts from perceptions of risk would be unlikely or relatively small.

Based on these analyses, DOE believes that the relationship between a repository and related transportation activities, and subsequent individual behavior is speculative because it does not necessarily depend on actual physical effects on individuals or the public at large. Moreover, the potential indirect effects of the proximity of a repository or of transportation activities on tourism or quality-of-life indicators would vary by individual, cannot be precisely defined, and are not reasonably foreseeable.

However, DOE will continue to work with local communities and tribal nations to understand and mitigate potential negative perceptions of DOE operations. These activities include the development and presentation of factual information regarding the actual (rather than perceived) risks associated with the construction, operation and monitoring, and eventual closure of a repository at Yucca Mountain and related transportation activities.

Given the integrity of the casks transporting the waste, and the fact that more than 2,500 shipments of spent nuclear fuel have been safely transported in the last 25 years with no fatalities, injuries, or environmental damage caused by the radioactive nature of the cargo, the chances of contamination of local communities and the environment from an incident involving this type of waste are extremely unlikely and not expected to occur. DOE believes that this waste can be transported safely.

8.8.2 (4357)
Comment - EIS001157 / 0002
Because Yucca Mountain is about 90 miles north of Las Vegas, the greatest impact to North Las Vegas will be the material transport phase. Specific impacts to North Las Vegas were not sufficiently addressed in the DEIS.

Response
Section 6.3 of the EIS provides DOE's analysis of transportation routes and their alternatives within Nevada. Note specifically that Table J-48 describes Case 6 that uses the proposed Las Vegas Beltway from Interstate-15 to U.S. 95. DOE used the best information on populations, infrastructure, planned improvements, and incident rates available at the time of the analysis. As part of the basis for the analysis, DOE evaluated *Assessment of the Hazards of Transporting Spent Nuclear Fuel and High Level Radioactive Waste to the Proposed Yucca Mountain Repository Using the Proposed Northern Las Vegas Beltway* (DIRS 155112-Berger Group 2000), which provided information specific to North Las Vegas.

8.8.2 (4365)
Comment - EIS001157 / 0011
If a rail line is built through the north end of the Las Vegas Valley, grade-separated crossings should be included as part of the project. The air quality and traffic congestion consequences of delaying vehicular traffic through the Las Vegas Valley are understated and mitigation measures need to be identified.

Response
Air quality and traffic congestion due to the operation of a branch rail line northeast of Las Vegas or any of the other branch rail line alternatives would not be a significant problem (see Section 6.3.2.2.5 of the EIS). If DOE used general freight service to transport the shipment to the branch rail line, the spent nuclear fuel or high-level radioactive waste railcars would be part of a potentially much larger train with commensurate delays at grade crossings regardless of the addition of a few railcars. However, if DOE chose dedicated rail, the train probably would consist of three to five railcars with little or no traffic buildup at grade crossings. Once the shipment(s) were on the branch rail line, the size of the train would result in little or no traffic buildups. At this time, DOE has not

determined the commercial arrangements it would request from railroads for shipment of spent nuclear fuel and high-level radioactive waste.

8.8.2 (4370)
Comment - EIS001157 / 0016
The vehicle emission analysis for the Las Vegas Valley was insufficient in two ways. First, it was based only on legal-weight trucks and did not consider the heavy-haul option which will create traffic congestion. Second, the reasoning for assuming only a limited impact was based on I-15 traffic volumes at Sahara Avenue, which is in the center of the City. None of the proposed routes go through this area, so a comparison using a more likely location (such as the permanent traffic recorder near the Apex interchange) should be used.

Response
Section 6.3.3 of the EIS evaluates air quality impacts due to vehicle emissions from heavy-haul trucks. In response to public comments, the EIS contains an expanded discussion of truck emissions in the Las Vegas Valley and the overall impacts on air quality.

8.8.2 (5529)
Comment - EIS001660 / 0039
The DEIS fails to adequately address impacts of the proposed action on existing surface transportation systems in affected Nevada counties. Transportation routes to Yucca Mountain would need to be improved. These routes are important for mining, interstate commerce, and mobility of all affected county residents and visitors. Also, a network of minor roads, mostly unpaved, serves affected county residents by providing access to public lands, private property, and mining claims. The DEIS must analyze and disclose the impacts of the proposed action on the railroad and the main improved highways. Specifically, it must consider: (1) the existing capacities of road and railroad links, in terms of both weight and traffic volume; (2) the anticipated increases in utilization of those links, in terms of weight and volume; (3) the impacts of those increases on rails, pavements, road beds, and travel times; and (4) whether the proposed action would create a need or demand for additional improved routes through affected counties in Nevada. Also, the DEIS must consider the impacts on the nation's rail transport system of an accident involving SNF [spent nuclear fuel] and HLW [high-level radioactive waste]. In the context of the mostly legal-weight truck scenario, I-80, US 50, NV 278, NV 376 (Lander and Nye Counties), US 6 (White Pine and Nye Counties, which is close to Mineral County), and other Nevada routes could be utilized as main alternate routes for transport of SNF and HLW. The impacts of the proposed action on the existing uses of those routes must be addressed in the DEIS, in addition to I- 15 in southern Nevada. Finally, the DEIS must disclose how access to minor roads would be affected and preserved.

Response
Sections 6.3 and J.3 of the EIS summarize the impacts of both incident-free truck and rail transportation and transportation accidents on Nevada. Section J.3.1 discusses the transportation modes, routes, and number of shipments of spent nuclear fuel and high-level radioactive waste for the different transportation implementing alternatives and their alignment variations. This information includes tables of information of potential upgrades needed for each option. This information provides the basis for the impact assessments. Details of impacts on existing surface transportation were evaluated in the following reference documents and summarized in the EIS. Impacts to traffic levels and road structures were evaluated in *Road Upgrades for Heavy Haul Truck Routes* (DIRS 154448-CRWMS M&O 1998); impacts to existing roads (paved and unpaved) were analyzed in *Rail Alignments Analysis* (DIRS 131242-CRWMS M&O 1997) where it was proposed to provide grade separations at major roads and at grade crossings at necessary minor roads. These analyses evaluated current traffic levels on existing roads, estimated increased traffic, and additional traffic due to spent nuclear fuel and high-level radioactive waste transport.

When a corridor or route was selected, detailed assessments and designs for rail alignments or heavy-haul truck road upgrades would be initiated. These studies would be part of engineering and environmental studies needed to develop detailed designs and to support specific National Environmental Policy Act reviews for the proposed actions. DOE would use routes that meet U.S. Department of Transportation requirements or routes designated by state or tribal routing agencies.

8.8.2 (6221)
Comment - EIS001904 / 0001
The primary concern of Elko County is for the health, safety, and welfare of it citizens. The draft environmental impact statement (DEIS) regarding the transportation of 70,000 metric tons of heavy metal (MTHM) of spent nuclear fuel and high-level waste through this county to connect a new railroad spur in Beowawe is not an acceptable transportation alternative. The Draft fails to address a host of concerns that this alternative might bring to Northern Nevada if this plan is accepted into the final EIS. The Draft is flawed because it has several transportation routes and methods of transport yet does not address the impacts or effects that would be incurred by these different scenarios.

The Carlin potential rail corridor alternative fails to address the fact that to get this new spur, the existing Union Pacific Rail Way lines will be used. This heavily used rail system will be furthered burdened by at least three to four of these radioactive waste trains traveling these lines each week for the next 24 years. The Draft EIS does not address the shared use of these rail lines that are also used for shipment of commercial explosives, military weapons and munitions, petroleum products, and other hazardous materials. [Nowhere] is the safety and environmental impacts considered in this Draft. The Department of Energy calls for shipping rail casks loaded with highly radioactive spent fuel in general freight trains and would require switching cars at the connection point thereby routinely parking loaded rail cask cars on side track for up to 48 hours. Further, most of the spent fuel is from the east and Midwest and if this rail line was used, these trains would pass through our most populous cities, namely Wells, Elko, and Carlin. The city of Elko is where the trains on this rail line change crews and it would follow that a crew change would be required for the radioactive waste trains as well in Elko, with a population 17,000 and an additional 10,000 people within 20 miles. [Nowhere] in the Draft EIS is our County mentioned as a potentially impacted area. There are no provisions for any type of Hazardous Material training for our emergency response personnel and no provisions for financial assistance if we were to be subjected to radiological disaster. The mention of upgrading of the existing rail lines as well as signalization upgrades, grade crossing or Right of way fencing is nonexistent in the Draft EIS.

Response
The EIS presents safety and environmental impacts (see Chapter 6 and Appendix J) of 10 implementing alternatives for transportation in Nevada by rail or heavy-haul truck including the construction of a branch rail line from Beowawe to Yucca Mountain. In addition, the use of legal-weight truck in Nevada is analyzed, including the sensitivity analysis of six alternative legal-weight truck routes. The analysis includes both construction-related impacts and operational impacts (including transportation of materials to the repository). As the analysis indicates, the impacts would be small regardless of which alternative was chosen. This indicates that impacts along any specific route and through any specific community would be small. In addition, the EIS presents an analysis of a generic community along the transportation route that indicates that community specific impacts would be small.

Decisions regarding the selection of a branch rail line for transporting spent nuclear fuel and high-level radioactive waste have not been made. However, it is in DOE's interest and in the interest of communities along a branch rail line to consider shared use of the line. This could involve shipments of other materials to Yucca Mountain, the Nevada Test Site, or shared usage with commercial interests. Before decisions would be made on the transportation alternatives associated with the Yucca Mountain Repository, the impacts such as shared use, would be evaluated. The specific conditions of any railway would be analyzed once specific decisions were made and potential upgrades implemented.

As requested, DOE would assist the State, tribal, and local governments in several ways to reduce the consequences of accidents related to the transportation of spent nuclear fuel and high-level radioactive waste. In addition, under Section 180(c) of the NWPA, DOE would provide technical assistance and funding to train State, local, and tribal public safety officials in safe transport procedures and emergency response. More details about the Section 180(c) process are provided in Appendix M of the EIS.

8.8.2 (6708)
Comment - EIS001878 / 0072
The DEIS fails to adequately address the impacts of the proposed action on existing surface transportation systems in Eureka County and other counties in Nevada. Interstate 80, US 50, NV 278, and NV 306 are the main improved routes in Eureka County. They are important routes for mining, interstate commerce, and the mobility of County

residents and visitors. The Union Pacific railroad generally parallels I-80 and the Humboldt River across the northern portion of the County. It is an essential component of the transportation network for interstate commerce and national defense. A network of minor roads also serves the residents of Eureka County, providing access to public lands, private property, and mining claims.

Principal transportation routes. The DEIS must analyze and disclose the impacts of the proposed action on the railroad and the main improved highways. Specifically, it must consider: (1) the existing capacities of road and railroad links, in terms of both weight and traffic volume, (2) the anticipated increases in utilization of those links, in terms of weight and volume, (3) the impacts of those increases on rails, pavements, road beds, and travel times, and (4) whether the proposed action would create a need or demand for additional improved routes through Eureka County.

Eureka County is especially concerned that utilization of the main Union Pacific tracks and facilities in the northern county could involve the storage of rail cars carrying SNF [spent nuclear fuel] and HLW [high-level radioactive waste] on sidings near Beowawe for extended periods of time. The impacts of such storage on transcontinental rail operations and on existing sidings in the vicinity (including those at Carlin and Dunphy) must be considered. In addition, the DEIS must consider the impacts upon the nation's rail transport system of an accident involving SNF and HLW and one of the UP bridges over the Humboldt River.

Alternative routes. In the context of the mostly legal-weight truck scenario, I-80, US 50, NV 278, NV 376 (in Lander and Nye Counties), US 6 (in White Pine and Nye Counties), and other Nevada routes could be utilized as main or alternate routes for the transport of SNF and HLW. The impacts of the proposed action on the existing uses of those routes must be addressed in the DEIS, in addition to I-15 in southern Nevada. Among other information, the DEIS must disclose the alternative routes that would be used, and the anticipated impacts along those routes, when rail or legal-weight truck operations are interrupted by flooding, range fires, and other natural events.

R.S. 2477 roads and other access routes. Rights of way over public lands for many roads were granted by Section 8 of chapter 262, 14 Statutes 253 (former 43 U.S.C. Sec. 932, commonly referred to as R.S. 2477) enacted in 1866. Such roads serve the public interest; provide access for fire control, law enforcement, search and rescue, medical personnel, and public utilities; provide access to public lands for members of the general public; and enhance the taxable value of the private property they serve.

Eureka County is concerned that many R.S. 2477 roads and other roads along the proposed Carlin corridor may be affected by construction of the roadbed, access roads, and fences. The DEIS must disclose: (1) whether the proposed action would result in the closing of any of these roads, (2) whether it would restrict access to them in any way, and (3) how the proposed action would ensure the continuity of such roads, through the use of at-grade crossings, underpasses, overpasses, or other means. Subsection 1 of Nevada Revised Statutes (NRS) 405.204 authorizes Nevada's attorney general to bring an action for declaratory judgment against an agency of the United States responsible for the lands over which an accessory road runs that pursues the closing of an accessory road or demands a fee or permit for its use.

Response

The current rail traffic on existing rail lines within Nevada is large (approximately 1,000 railcars per day) compared to the railcars per week that could be expected with spent nuclear fuel or high-level radioactive waste destined for Yucca Mountain. The increase in rail traffic would have little or no impact on the existing rail infrastructure. DOE has identified rail as its preferred mode of transportation within Nevada. It is not expected that the construction of a branch rail line would affect R.S. 2477 roads and other roads along the candidate rail corridors.

The incident-free transportation analysis considers the stop of railcars in classification yards throughout its journey from origin to destination. These classification stops are assumed to occur once in the state of origin, once in the state of destination, and a number of times in between depending on the number of kilometers traveled. The population density at each of the stops is conservatively assumed to be a suburban population zone (719 persons per square kilometer). Therefore, any layover of railcars in Nevada while awaiting transfer to a train for travel to Yucca Mountain has been addressed in the EIS.

The accident analysis in the EIS considered the impacts of low probability severe accidents. If an accident was severe enough to require closing the railroad track at the location of the accident, alternative routing measures could be employed to circumvent the area of the accident.

For the mostly legal-weight truck scenario in Nevada, the analysis looked at the routing according to U.S. Department of Transportation routing regulations and analyzed the impacts of six alternative legal-weight truck routes. The analysis indicated that there were not significant differences in impacts across the legal-weight truck routing alternatives.

Following are responses to the three specific requests for disclosure:

- The closing of specific roads is not anticipated although specific routes have not been defined.
- Specific access to these roads has not been designed but access is not expected to be restricted.
- The continuity of these roads would be determined by DOE and the State using the route/mode decision process.

8.8.2 (7011)
Comment - EIS001887 / 0140
Page 2-81; Section 2.4.4.2 - Nevada Transportation

The Draft EIS states, "With the exception of Land Use, differences in environmental impacts for the ten implementing alternatives related to incoming shipments by rail would be small, so environmental impacts do not appear to be a major factor in the selection of transportation mode, route, or corridor in Nevada for incoming rail shipments." This statement is inaccurate. Rail operations associated with heavy-haul shipments present major problems for the operational highway network in Nevada. The Draft EIS ignores such impacts as traffic queuing, failing structural sections, remedial actions for reducing traffic accidents, and institutional anomalies (such as providing a portable crane capable of lifting overturned vehicles and casks).

Response
As discussed in Section J.3.1.2 of the EIS, several highway upgrades would be proposed for any of the five heavy-haul truck implementing alternatives. There is a table listing and describing the upgrades proposed for each route. Nevada highways upgraded for heavy-haul truck use would include new truck turnout lanes at frequent intervals along two-lane highways to allow other traffic to pass the slower heavy-haul vehicles in order to reduce traffic queuing. A detailed analysis of structural sections, remedial actions for reducing traffic accidents, and institutional anomalies would be conducted in subsequent engineering and environmental analyses once a mode and route were selected. As a part of these studies, government agency consultation and appropriate National Environmental Policy Act reviews would be conducted. In addition, as a part of the permitting process, the State Engineer may, as necessary, conduct an engineering evaluation (including a structural analysis) of the proposed heavy-haul truck route according to Nevada Administrative Code Chapter 484.530. Cranes and equipment used for non-NWPA rail incidents could handle NWPA equipment, including casks.

8.8.2 (7043)
Comment - EIS001160 / 0044
It is very difficult within the DEIS to evaluate impact on communities in the major zone of influence. One is hard pressed to find any quantification of how many actual legal weight truck haul loads could be expected through Ely on the US 93 or SR 318 scenario. The table on J-7 might indicate around 1500 shipments from the Idaho National Engineering and Environmental Laboratory 800 shipments from Hanford that might use a route through Ely as an alternate to Interstate routes, spread over a 20-year period (Table J-4). It would be useful if there was analysis of some key points like Ely (apparently a relatively low impact area with about 350 shipments of high-level radioactive waste a year, Table J-4) as opposed to perhaps high impact Mesquite with perhaps an average of 1700 shipments a year of commercial spent nuclear fuel (Figure J-10).

Response
As described in Section 2.1.3.2 of the EIS, the Department describes the national transportation scenarios and provides maps of the Interstate Highway System and the national rail system. Under the Proposed Action, DOE would ship spent nuclear fuel and high-level radioactive waste from 72 commercial and 5 DOE sites in some combination of legal-weight truck, rail, heavy-haul truck, and possibly barge. Because DOE cannot anticipate the exact number of shipments and mode that would be used, the EIS considers two transportation scenarios, a mostly legal-weight truck scenario and a mostly rail scenario, in order to illustrate the broadest range of operating conditions relevant to potential impacts to human health and the environment (see Table 2-2 of the EIS).

In addition to analyzing the impacts of using highway routes that would meet U.S. Department of Transportation requirements for transporting spent nuclear fuel (49 CFR Part 397), DOE evaluated how the estimated impacts would differ if legal-weight trucks used other routes in Nevada, including representative routes that would pass through the community of Ely (see Table J-47 of the EIS). This analysis was made for the range of operating conditions illustrated in the mostly legal-weight truck scenario and the mostly rail scenario (see Section J.3.1.3). Under the range of operating conditions, DOE assumed that all legal-weight shipments would travel along the given routes under each of the scenarios. The results of this analysis can be found in Table J-48, which indicates the variations in impacts between various Nevada routes. The impacts to the community of Ely would be a small fraction of the impacts to Nevada. In response to public comments on the Draft EIS, DOE has included an analysis for a maximally exposed individual of a small community in Section 6.3. Section J.4 contains maps of each state where shipments would originate or through which they would pass. Each state map lists the number of shipments used in the analysis and the impacts within the state of such shipments.

DOE expects that the mostly rail scenario best represents the mix of truck and rail transportation modes it would use. To determine this mix, DOE considered whether sites are able to handle larger (rail) casks, distances to suitable railheads, and historic precedent in actual shipments of fuel, waste or other large reactor-related components. DOE also has considered relevant information published by knowledgeable sources such as the Nuclear Energy Institute and the State of Nevada. The analysis has confirmed DOE's belief that the mostly legal-weight truck and mostly rail scenarios provide the range (lower and upper bound) of environmental impacts from the transportation of spent nuclear fuel and high-level radioactive waste.

8.8.2 (7141)
Comment - EIS001337 / 0038
The County [Lincoln] and City [Caliente] recommended that an assessment of paleontologic resources within alternative rail corridors and at potential borrow pit sites within Lincoln County be conducted and reported on within the scope of the repository DEIS. The DEIS does not identify potential borrow pits and therefor has not included an assessment of the paleontologic resources at such sites. Such an omission makes the document less useful as a decision-support tool, particularly in choosing among transportation corridor alternatives.

Response
As stated in Section 6.3 of the EIS, the evaluation of impacts of cultural resources considered the potential for disrupting or modifying the character of archaeological or historic sites, artifacts, and other cultural resources. The region of influence for the analysis included the lands in the 400-meter (0.25-mile)-wide rail corridors. Cultural resource impacts of each rail corridor implementing alternative are provided in Section 6.3.2.2. Should the mostly rail transportation scenario be selected and a preferred corridor identified, additional engineering and environmental studies would be initiated to select a specific alignment of the tracks within the selected corridor. Appropriate National Environmental Policy Act reviews would be conducted to support selection of a specific alignment and design. Borrow pits would not be identified and assessed for cultural resources until geotechnical surveys and other environmental studies were conducted in conjunction with subsequent design activities following the selection of a rail corridor or intermodal transfer station location. An assessment of paleontologic resources at borrow pits would be included in such National Environmental Policy Act reviews for the specific rail alignment.

8.8.2 (7521)
Comment - EIS001912 / 0050
Section 3.2.2.1. Did any member of the EIS team make site visits and site investigations for the various rail corridor alternatives? If yes, please explain the nature of the investigations?

Response
Section 3.2.2.1 of the EIS is based on a combination of published information and field observations. Based on published environmental data, 54 springs, perennial streams, and Bureau of Land Management-designated riparian areas were visited by DOE biologists to determine if those sites contain wetlands (DIRS 155378-Reilly and Smith 1997). Fifteen locations with sensitive species were visited to ensure that the sites still had suitable habitat for the species (DIRS 154825-CRWMS M&O 1997). In addition, DOE engineers made an initial visual survey of all rail corridor alternatives as a part of the routing analysis. Topography, land use, and known areas of environmental concern were observed as a part of the corridor centerline selection to minimize impacts to stakeholders (DIRS 131242-CRWMS M&O 1997). Cultural resources, noise, aesthetics, and existing visual conditions were observed by contractor personnel on a field trip along proposed heavy-haul truck routes and rail corridors. Additional interviews with responsible State and Federal agencies were conducted and additional literature searches were performed during the trip. A report has been prepared detailing the information obtained during the trip (DIRS 155826-Nickens and Hartwell 2001) and the relevant information is included in Chapter 6 of the EIS.

8.8.2 (8725)
Comment - EIS002119 / 0010
And last, I'd like to mention that should there be an incident, even if the routes do not go through Clark County, under certain governmental agreements, we do provide as a large county with a number of resources assistance to other counties, nearby counties in the event of hazardous materials or nuclear materials or waste incidents. And lastly, I'd like to say that this community, Clark County and its urban areas especially and rural areas has been built up from the desert. We have developed. There have been the talents and skills and efforts of a number of people, many of whom have testified here. This has value. There's value in the quality of life. There's value economically. There's value for the future. And these have not been given serious consideration in the DEIS.

Response
Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to state, local, and tribal governments to support training of public safety officials to help ensure safe routine transportation and emergency response for shipments to a repository. The state could provide funds allocated under Section 180(c) to support a county providing assistance to other jurisdictions through mutual aid agreements. Appendix M of the EIS contains more information on Section 180(c).

8.8.2 (9431)
Comment - EIS001593 / 0002
You have got several railroads that would go to this Yucca Mountain, proposed possible railroads, and one of them, this Chalk Mountain or Caliente Chalk Mountain Route, I believe is what it's called, would go through the Air Force's Flying Saucer Base out in Nevada.

Now, I don't know if it is so much interesting from an environmental standpoint, but you know, we hear a lot about this rogue agency, you've heard some today about this rogue agency, rogue power behind nuclear power, the Nuclear Power Industry. Well, I am, actually a little more worried about this black operation crowd out there in Nevada, and I would just love to see a knock-down, drag-out fight between the two of you.

Now that would be -- I think that could really open up -- you know, people wonder, you know, if this isn't some kind of military coup, I mean, all this secret stuff, and wondering, you know, if elected officials are really in control.

Response
DOE reevaluated whether the Caliente-Chalk Mountain Corridor and the Caliente/Chalk Mountain heavy-haul truck route should be eliminated from further evaluation. DOE met with the Air Force (see Appendix C of the EIS), considered the information provided, and concluded that the Caliente-Chalk Mountain Corridor and the Caliente/Chalk Mountain heavy-haul truck route implementing alternatives should remain identified as "nonpreferred alternatives" in this Final EIS.

DOE has not identified a particular rail corridor or heavy-haul truck route as "environmentally preferable." If the site was approved and a mode of transportation (rail or heavy-haul truck in Nevada) was selected in a Record of Decision, DOE would then identify an environmentally preferable corridor or route in a subsequent Record of Decision to select a rail corridor or heavy-haul truck route. In making such a determination, DOE would consider a

variety of environmental factors, including many raised by the commenters. The potential environmental impacts from the construction and operation of the Caliente-Chalk Mountain Corridor and the Caliente/Chalk Mountain heavy-haul truck route are included in Sections 6.3.2.2.3and 6.3.3.2.2 of the EIS.

8.8.2 (9607)
Comment - EIS001888 / 0279
An analysis of the risks and impacts of the heavy haul transportation routes through urban Clark County. This analysis should examine the traffic impact of the transportation as well as the risks of this unprecedented program. The engineering data should be modified to include the costs to acquire right of way for the additional travel lanes. The report should also include an estimate of the costs to improve existing infrastructure to accommodate the transportation program.

Response
DOE analyzed heavy-haul truck implementing alternatives in EIS Section 6.3.3, including routes through Clark County. In this analysis, DOE assumed that heavy-haul truck shipments in Clark County would utilize the planned Las Vegas Beltway. In doing so, DOE assumed that funding would be made available to accelerate Beltway Phase II construction to meet a 2010 transport date. DOE used the best available cost estimate for Beltway Phase II construction, taken from the *Environmental Study for the Northern and Western Las Vegas Beltway Transportation Facilities and Right-of-Way Footprint* (DIRS 103710-Clark County 1997). Costs to acquire right-of-way for additional travel lanes and costs to improve existing Nevada highway infrastructure to accommodate a heavy-haul truck transportation campaign are included in the Department's cost estimate (DIRS 154675-Ahmer 1998). However, Interstate System highways, and the Las Vegas Beltway after Phase II construction, would not need improvement because they meet, or will meet, standards necessary to sustain heavy-haul truck shipments.

8.8.2 (9664)
Comment - EIS002074 / 0008
With respect to the intermodal sites that was stated in the American Indian prospectus on the Yucca Mountain Site Characterization Project that was done by the American Indian Writers subgroup, there's been no systemic ethnographic interviews that have been conducted to evaluate the epidemiological and sociological impacts to Indian people and their communities regarding cultural resources of sacred sites. The studies only focus on the impacts to the physical artifacts and no subsistence patterns, no traditional eligibility for traditional cultural properties or cultural landscape as considered in the bulletin number 30 and 38 by the National Park Service.

Response
Section 3.2.2.1.5 of the EIS discusses the existing, documented information on cultural resources along the candidate rail corridors. Limited field surveys were conducted (DIRS 155826-Nickens and Hartwell 2001). Should the mostly rail transportation scenario be selected and a preferred corridor identified, additional engineering and environmental studies would be initiated to select a specific alignment. During this process, specific data-gathering efforts and analyses would be conducted, including focused cultural resource studies and Native American consultations, as well as consultations with responsible State and Federal agencies, as applicable. Appropriate National Environmental Policy Act reviews would be conducted to support selection of a specific alignment and design.

8.8.2 (9671)
Comment - EIS002074 / 0016
With health and safety, and this is just going down on the record, is that there is concern by this group of terrorism and felt that the potential of those kind of situations occurring, as well as looking at the potential of derailments. It was felt that there was an accident that happened, I believe it was December 24th in 1997 or 1998, on the Caliente, that that was not felt that it was adequately considered or there was an indication as to how those kinds of things could occur -- I mean, how those kinds of things were considered into the decisions of looking at various sites, including the Caliente intermodal site.

Response
In the Final EIS, DOE estimated that the greatest consequences would occur if the sabotage event occurred in the center of a highly populated metropolitan area. The dose from such an event to a maximally exposed individual (about 110 rem over the person's lifetime) would increase his or her lifetime risk of a fatal cancer from about

23 percent to about 28 percent. However, doses to most affected individuals would be much lower than that to the maximally exposed individual; these individuals' increased risk of a latent fatal cancer would also be lower. It was not predicted that there would be any prompt fatalities from very high levels of exposure, and immediate health consequences from radiation exposure would be unlikely, but by combining the large number of small individual risks in the population of a metropolitan area, DOE estimated that a sabotage event could lead to as many as 48 latent fatal cancers. Although not estimated in the analysis, injuries and deaths from blast effects of a device that might be used would be expected for individuals who would be as close to the event as the hypothesized maximally exposed individual. However, exposure to radioactive materials sufficient to lead to an individual lifetime dose of 110 rem could result in a need for medical attention. DOE designed the analyses to identify the maximum consequences that a severe accident could reasonably be expected to produce (reasonably expected is defined as a likelihood greater than, but on the order of, 1 in 10 million in a year), but the analysis did not make extreme assumptions that would identify the worst possible consequences that could be imagined.

DOE believes that a shipment of spent nuclear fuel or high-level radioactive waste would be an unlikely target in part due to the physical security measures imposed by the Nuclear Regulatory Commission regulations. Under certain conditions, armed escorts would either follow or ride in the truck cab or an escort railcar. DOE would monitor its spent nuclear fuel and high-level radioactive waste shipments through a satellite-based tracking system.

8.8.2 (9771)
Comment - EIS001160 / 0123
The use of conventional highway traffic data, while convenient may have limited applicability when examining scenarios within White Pine County.

Response
The highway traffic data used to estimate impacts on the highways within Nevada are representative of the types of trucks that would be utilized to transport spent nuclear fuel and high-level radioactive waste within Nevada. National, State, and regional traffic data were used to ensure that transportation analyses were representative. Reviewing the references for Section 6 and Appendix J of the EIS shows the breadth and depth of traffic data used.

8.8.2 (10232)
Comment - EIS002115 / 0007
Other transportation issues of the waste to the site are: Mode, not clearly identified. Three possible modes of transportation are identified.

The waste could be driven on interstates using legal weight trucks. It could be sent by train, which includes five options of building a railroad to Yucca Mountain. It could be transported by heavy-haul, which is rail to a transfer point in Nevada, then transferred to 220 foot heavy-haul trucks and transported to Yucca Mountain. Routing, many possible routes not studied adequately. Rural areas do not have good or safe roads to transport this nuclear waste, especially if alternative routes are selected, nor do they have railroads to get it to Yucca Mountain. Land use. Consideration of present and planned land uses along possible routes identified.

Response
DOE used current regulations governing highway shipments and historic rail industry practices to select existing highway and rail routes to estimate potential environmental impacts. These routes are representative of the routes that the Department could use to transport spent nuclear fuel and high-level radioactive waste to Yucca Mountain. Section J.3.1.2 of the EIS discusses the rail implementing alternatives, which are the five candidate rail routes in Nevada to Yucca Mountain.

In addition, Section J.3.1.3 of the EIS describes the sensitivity of the impact analysis to the routing assumptions. With regard to land-use impacts, Sections 6.1.2.1 and J.3 discuss land-use impacts associated with the transportation implementing alternatives. If DOE selected a specific alternative, it would complete a more detailed analysis of environmental, engineering, and socioeconomic impacts along the corridor.

8.8.2 (10770)
Comment - EIS002144 / 0007
The Department of Energy operations office puts you guys to shame. They've done studies that we've told them to do. They came to us last year says, "Hey, we got studies this thick about intermodal transportation to the Nevada Test Site." We did an EA on it -- on the same thing that they had. They had $350,000.00. We had ten days to do this and about a hundred dollars a day per person to do it. When we got finished, our document was five times bigger. Our document talked about transportation. How are you going to get it there? How is it going to get there in the first place. And then after that, what's going to happen?

Our document talked about a lot farther than a half mile, because our document talked about real life. When -- when a crow flies in, he's not coming in just from a half mile; he's coming in from many miles away, and every time he goes to the bathroom, he drops that radiated part out of his body. Coyotes don't just come from a half mile away. Eagles don't just come from half mile away. They all come from a lot farther, and they don't consider that because they say -- and they're right. I'm not a scientific person. I know from my experience at home and my teachings from my people what we -- what has happened and what is going to happen, and it's a shame that we -- that I have to cry and scream and yell just like you at your site and go home.

Response
The analysis of impacts from the construction and operation of an intermodal transfer station in Section J.3.3.1 of the EIS indicated that there are no credible accidents that would result in a release of radioactive material. The analysis evaluated radiological and nonradiological impacts and found that they would be low.

8.8.2 (11277)
Comment - EIS001814 / 0011
DEIS Page 2-9
DOE is looking at three transportation scenarios for Nevada. These scenarios include legal-weight truck and rail, which are the same as the national scenarios but highlight the Nevada portion of the transportation, and heavy-haul truck.

Although DOE maintains that the "mostly legal weight truck" and "mostly rail" scenarios adequately bound the analysis for the national transportation scenarios, this is not true for the Nevada Transportation Scenarios. Under the "mostly legal weight truck" scenario, DOE must still deal with more than 300 rail shipments of high-level waste and Naval fuel (references). The Nevada Transportation Scenario fails to describe how DOE will deal with these shipments without either constructing a rail line or operating an intermodal transfer site and heavy-haul.

Response
Section 2.1.3.3.1 of the EIS states that DOE would use heavy-haul trucks and would establish an intermodal transfer capability. These 300 shipments would be spread over a 24-year period, which would arrive within Nevada by rail. Section 6.3.3 states, "This EIS assumed that DOE would not build an intermodal transfer station to handle those shipments." The intermodal transfer capability would consist of a suitable crane and an existing rail siding suitable for transferring the transportation cask (approximately 12 per year) onto a heavy-haul truck described in Figure 2-28. In this limited heavy-haul truck scenario, there would be no road upgrades required as described in this section for the mostly rail scenario. Nevada Department of Transportation currently issues approximately 400 permits on a single-trip permit basis for vehicles capable of transporting 68 metric tons (75 tons) or more payload on the five candidate heavy-haul truck routes evaluated in the EIS, excluding the use of the Las Vegas Beltway. DOE believes that the 12 additional heavy-haul truck shipments per year on these roads would not warrant large-scale, costly highway improvements that are included in the mostly rail scenario, nor would they cause significant additional highway deterioration or traffic hazards.

8.8.2 (11278)
Comment - EIS001814 / 0012
DEIS Page 2-40
These scenarios illustrate the broadest range of operating conditions relevant to potential impacts to human health and environment.

This statement is incorrect, since the "Mostly LWT [legal-weight truck]" scenario includes rail shipments. Without constructing a new rail line in Nevada or operating an intermodal transfer and heavy-haul in Nevada, the shipments dependant on rail will either have to be repackaged in smaller containers in Nevada or not shipped to the proposed repository at Yucca Mountain.

Response
As described in Section 2.1.3.2.1 of the EIS, part of the mostly legal-weight truck scenario includes the shipment of naval spent nuclear fuel that would be shipped to Nevada by rail. These shipments incorporate approximately 300 shipments over a 24-year operational period. The EIS assumed that these shipments would use the services of a commercial intermodal operator. The EIS also assumed that DOE would not build an intermodal transfer station to handle naval spent nuclear fuel shipments. Naval spent nuclear fuel shipments, equating to approximately 16 casks per year, would then be shipped from the intermodal transfer point to Yucca Mountain by heavy-haul truck as described in Section 6.3.3.1. It is the Department's opinion that the EIS adequately analyzes the mostly legal-weight truck transportation shipping scenario.

8.8.2 (11285)
Comment - EIS001814 / 0017
DEIS Page 2-49
Construction activities would include the development of construction support areas; construction of access roads to the rail line construction initiation points and to major structures to be built, such as bridges; and movement of equipment to the construction initiation points. The number and location of construction initiation points would be based on such variables as the route selected, the length of the line, the construction schedule, the number of contractors used for construction, the number of structures to be built, and the locations of existing access roads adjacent to the rail line.

The construction activities listed cannot be completed without some environmental impact, and will require appropriate mitigative measures. Without a detailed description of these activities it is impossible to conclude that they can be completed without causing unacceptable adverse environmental impacts, even with mitigative measures. Until these construction activities are specified, DOE cannot conclude that the proposed action will not result in unacceptable impacts as required by the National Environmental Policy Act.

Response
Section 6.3 of the EIS describes different categories of environmental information acquired and evaluated for Nevada transportation. The results of the evaluation of this information for each mode and route in Nevada are provided in the subsequent sections. Should the mostly rail transportation scenario be selected and a preferred corridor identified, additional engineering and environmental studies would be initiated to select a specific alignment of the tracks within the selected corridor and related construction activities. Appropriate National Environmental Policy Act reviews would be conducted to support selection of a specific alignment and design. Detailed branch rail line construction activities would be evaluated in subsequent engineering and environmental analyses in conjunction with government agency consultation and evaluated in appropriate National Environmental Policy Act reviews conducted in union with these analyses and consultations. Access roads and construction support areas would be evaluated as short-term temporary impacts.

8.8.2 (11286)
Comment - EIS001814 / 0018
DEIS Page 2-50
Railroad track construction would consist of the placement of railbed material, ties, rail, and ballast (support and stabilizing materials for the rail ties) over the completed railbed platform.

Construction of the railroad in any of the proposed rail corridors will require significant quantities of ballast and probably significant quantities of sub-ballast. The EIS does not provide a description of the source for these materials. The quantity of ballast and sub-ballast required should be accurately defined, and sources for the material described. Quarrying the ballast and sub-ballast could result in significant environmental impacts not assessed in the EIS.

Response
Detailed evaluations for the source of sub-ballast, ballast, and fill materials would be performed in subsequent National Environmental Policy Act evaluations, should rail be selected as the preferred mode for transportation. Determination of material sources is very route-specific, and the detailed engineering required to develop accurate source requirements is more applicable to the next level of National Environmental Policy Act activities, once a route had been selected. Preliminary quantities of fill material, sub-ballast, and ballast were evaluated in *Nevada Transportation Study Construction Cost Estimate* (DIRS 154822-CRWMS M&O 1998).

The estimated land disturbance for obtaining fill materials was included in the land disturbance quantities in the EIS. The ballast and sub-ballast materials were assumed to be available from existing quarries, either in Nevada or from quarries in neighboring states. Sub-ballast and ballast materials could be transported to the rail construction site by completed rail section. Therefore, the transportation of those materials from quarries in other parts of the country is not a great economic differentiation, unlike the transportation of the base fill materials that would have to be transported by truck. Fill material transport would a significant cost driver, which would require the use of local borrow sources. This is why the EIS includes fill borrow source disturbed land and not sub-ballast and ballast borrow source estimates.

8.8.2 (11287)
Comment - EIS001814 / 0019
DEIS Page 2-50
Other activities would include the following: Installation of fences along the rail line, if requested by other agencies (for example, the Bureau of Land Management or the Fish and Wildlife Service).

The description of the proposed action should include the location and type of fencing to be installed. Without this information, it is not possible to assess the impacts of the proposed action, particularly on wildlife and on land use. The two agencies listed could, in fact, request conflicting requirements for fencing based upon the impact within their area of jurisdiction. Depending on the types and locations of fencing, the proposed action could create significant impacts to wildlife, particularly where the proposed corridors cross critical habitat areas.

Response
Section 6.3 of the EIS addresses the potential needs for fencing under the categories of land use and ownership and biological resources, and identifies potential impacts. Should the mostly rail transportation scenario be selected and a preferred corridor identified, additional engineering and environmental studies would be initiated to select a specific alignment of the tracks within the selected corridor. Appropriate National Environmental Policy Act reviews would be conducted to support selection of a specific alignment and design. Detailed analysis of fencing locations and types would be evaluated in subsequent engineering and environmental analyses and government agency consultation and evaluated in appropriate National Environmental Policy Act reviews conducted in conjunction with these analyses and consultations. It is the Department's opinion that the EIS adequately analyzes potential needs for fencing along candidate railroads and roadways, and their use and impacts.

8.8.2 (11288)
Comment - EIS001814 / 0020
DEIS Page 2-50
This EIS assumes there would be about four trains per week for shipments of spent nuclear fuel and high-level radioactive waste to the repository. In addition, the rail line would enable the transport of other material to the repository, including empty disposal containers, bulk concrete materials, steel, large equipment, and general building materials. The EIS assumes one train per week for this other material for a total of about five trains per week to the repository from about 2010 to 2033.

The EIS does not include an estimate of the number of trains leaving the repository. This would presumably include return of empty shipping casks as well as additional unloaded cars that were used to ship materials to the site. One cannot automatically assume that the number of unloaded trains leaving the repository will be the same as the number of loaded trains arriving. Therefore, it is not possible to assess the impacts of the rail line from the description of the proposed action.

Although discussed in the references to the EIS, this EIS does not discuss the different options for ownership and operation of the rail line or the possibility that the rail line would be used for other purposes than the proposed action described in the EIS. Use for other types of shipments could increase the impacts of the proposed action above that is described in the EIS.

Response
All transportation in the EIS is considered to be round-trip. Therefore, the transportation discussed in the comment (the return trip from the repository) is addressed in the EIS. Section 8.4.2 of the EIS discusses the shared use of a branch rail line. Decisions regarding the selection of a branch rail line for transporting spent nuclear fuel and high-level radioactive waste have not been made. However, it is in DOE's interest and in the interest of communities along a branch rail line to consider shared use. Before decisions were made on the transportation alternatives associated with the Yucca Mountain Repository, the impacts, such as shared use, would be evaluated. In addition, the NWPA, through its section on consultation and cooperation, requires DOE to consult with affected units of local government. Potential benefits of the shared use of the branch rail line would be explored through that process.

8.8.2 (11293)
Comment - EIS001814 / 0022
DEIS Page 2-51
Intermodal transfer station operations would depend on whether the railcars that carried spent nuclear fuel and high-level radioactive waste arrived on dedicated or general freight trains.

DOE states that there will be operational differences for the intermodal transfer station between the dedicated train and general freight options. The EIS, however, does not contain sufficient information on these differences to allow an evaluation of the difference in impacts between the two options. The difference between staging requirements for the heavy-haul vehicles for the two options should be described. If general freight was used, the EIS states that the "General freight trains would switch from the main Union Pacific track to an existing or newly constructed passing track." The EIS does not state where the existing or newly constructed passing track would be located. If it is located at the intermodal transfer station, this would significantly alter the design of the station. If a new passing track is constructed at a location independent of the station, this would create potential impacts that have not been evaluated. Even if an "existing passing track" is used, this would probably require the Union Pacific to construct a new passing track for other railroad traffic.

Response
Table J-25 in the EIS presents a comparison of general freight and dedicated rail service. However, available information has not indicated a clear overall advantage of using general freight or dedicated rail service for the transportation of spent nuclear fuel and high-level radioactive waste. At this time DOE has not determined the commercial arrangements (dedicated or regular freight) it would request from railroads for shipment of spent nuclear fuel and high-level radioactive waste. Once that determination was made, the logistics of transporting the railcar(s) would be discussed with the rail carriers, states, tribes, and other stakeholders.

8.8.2 (11296)
Comment - EIS001814 / 0025
DEIS Page 2-54
Most borrow material for construction could come from existing Nevada Department of Transportation borrow areas, if the State agreed.

Most road design projects attempt to balance cut and fill requirements during construction of the roads. Therefore, it is not reasonable to assume that borrow material will be available in existing borrow areas for the extensive fill requirements necessary to construct truck climbing lanes and other road improvements. Obtaining fill material from other areas could result in significant impacts not discussed within the EIS.

Response
Section J.3.1 of the EIS discusses the transportation modes, routes, and number of shipments of spent nuclear fuel and high-level radioactive waste for the different transportation implementing alternatives and their alignment variations. This information includes tables of information of potential upgrades needed for each option. This information provides the basis for the impact assessments. Details of impacts on existing surface transportation was

evaluated in CRWMS M&O (DIRS 154448-1998) and summarized in the EIS. These analyses evaluated current traffic levels on existing roads, estimated increased traffic, and additional traffic due to spent nuclear fuel and high-level radioactive waste transport.

Costs estimated for the road upgrades associated with the heavy-haul truck transportation systems assumed that fill material would be hauled in from existing borrow areas. If the State's current borrow areas were insufficient to provide the material needed, the fill would be obtained from existing private borrow sources or quarries.

When a corridor or route was selected, detailed assessments and designs for rail alignments or heavy-haul truck road upgrades would be initiated. These studies would be part of engineering and environmental studies needed to develop detailed designs and to support appropriate National Environmental Policy Act reviews for the proposed actions. DOE would use routes that meet U.S. Department of Transportation requirements or were designated by State routing agencies.

8.8.2 (11304)
Comment - EIS001814 / 0033
DEIS Page 3-100
DOE expects waste quantities generated by rail line construction and operation to be minor in comparison to those from repository construction and operation. As such, no discussion of existing waste disposal infrastructure along the routes is provided.

It is true that waste quantities generated by rail line construction and operation should be minor in comparison to those from repository construction and operation. The comparison, however, is meaningless. Most of the rail construction would take place far from the repository, much of it in remote, sparsely populated areas. Waste generated during the rail construction will undoubtedly not be hauled to the same disposal site as waste generated during repository construction. Rather, it will be disposed in facilities along the corridor.

What is significant, therefore, is the volume and type of waste generated by rail line construction and operation in comparison to the capacity of waste disposal facilities along the various corridors. Given the remote, sparsely populated areas crossed by the proposed rail line, solid waste disposal facilities probably do not have sufficient capacity to handle waste generated during rail construction. Many times construction waste is not compatible with the waste handling facilities at existing sites. (Note: this same discussion applies to the intermodal transfer station and heavy-haul routes.)

Response
Section 6.3 of the EIS addresses waste generated by branch rail line construction and operation. It was assumed that the waste materials from construction and operation of a branch rail line would be transported to a facility with sufficient capacity to dispose of the waste material without any undue impacts. Should the mostly rail transportation scenario be selected and a preferred corridor identified, additional engineering and environmental studies would be initiated to select a specific alignment of the tracks within the selected corridor and evaluate the impacts of construction and operation of the branch rail line and supporting facilities. Appropriate National Environmental Policy Act reviews would be conducted to support selection of a specific alignment and design. Details on the location of such a facility would be further evaluated if a branch rail line was selected.

8.8.3 SPECIAL TOPICS

8.8.3 (171)
Comment - 42 comments summarized
Commenters disagreed with DOE's conclusion that there would be no environmental justice impacts from spent nuclear fuel and high-level radioactive waste transportation to Yucca Mountain and stated that the Draft EIS findings regarding environmental justice were unjustified since analysis along specific transportation routes was not conducted. Commenters stated that actual routes on a segment-by-segment basis must be considered when estimating impacts (latent cancer fatalities) to low-income or minority communities. Commenters stated that it is well known that low-income and minority communities are located along railroads and highways and that DOE would need to name the transportation routes and prepare maps to show the locations of potentially affected minority and low-income populations. As analyzed in the EIS, it is impossible to assess whether impacts would fall

inequitably on certain sectors of the population. Another commenter stated that the so-called "hypothetical" populations analyzed in the EIS in fact comprise low-income and minority populations that already have experienced disproportionate impacts and compromised their quality of life because of previous environmental decisionmaking. Commenters gave examples of specific communities that could be affected depending on the selected transportation route, such as the Duckwater and Ely Shoshone Reservations in Nevada, Interstate-70 through Denver, Interstate-90/State Route 2 "Shoreway" through Cleveland, communities in San Bernardino County, California, and the Interstate-25 corridor. Another commenter stated that certain types of trucks are barred from traveling on elevated highways (Interstate-70), and so must pass through minority neighborhoods near residences and schoolyards. Commenters stated that because of the generic nature of the national transportation analysis, DOE could not substantiate the statement that there would not be disproportionately high and adverse impacts to minority or low-income populations from the Proposed Action.

Response

Consistent with Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, DOE performs environmental justice analyses to identify and address, as appropriate, the potential for its actions to cause disproportionately high and adverse impacts to minority or low-income populations. The approach to environmental justice analysis in the Draft EIS and Final EIS is consistent with Council on Environmental Quality guidance. The goal of this approach is to identify whether any high and adverse impacts would fall disproportionately on minority and low-income populations. The approach first analyzes the potential impacts on the general population as a basis for comparison. Second, based on available information, the approach assesses whether there are unique exposure pathways, sensitivities, or cultural practices that would result in high and adverse impacts on minority and low-income populations. If such potential impacts would be high and adverse, the approach then compares the impacts on minority and low-income populations to those on the general population to determine whether any high and adverse impacts fall disproportionately on minority and low-income populations. In other words, if high and adverse impacts on a minority or low-income population would not appreciably exceed the same type of impacts on the general population, no disproportionately high and adverse impacts would be expected.

In response to comments, DOE has reevaluated available information to determine whether the Draft EIS overlooked any unique exposure pathways or unique resource uses that could create opportunities for disproportionately high and adverse impacts to minority and low-income populations, even though the impacts to the general population would not be high and adverse. Additional unique pathways and resources were identified and analyzed, although none revealed a potential for disproportionately high and adverse impacts. For example, DOE estimated the potential health impacts from a subsistence diet based primarily on game taken from lands near the repository exclusion areas and concluded that high and adverse health and safety impacts would be unlikely.

DOE has updated and refined information germane to its environmental justice analysis. The EIS now includes, for example, additional and more detailed mapping of minority populations, and additional mapping and information that describes the proximity of tribal lands and cultural and ceremonial areas to candidate rail corridors in Nevada. Based on the additional information and resulting analysis, DOE has concluded that disproportionately high and adverse impacts from the construction and operation of a branch rail line or intermodal transfer facility would be unlikely.

The EIS analyzes potential public health effects of both routine (incident-free) transportation of radioactive materials and transportation accidents involving radioactive materials. First, regarding routine transportation, the EIS considers air emissions and doses from exposure to radioactive materials during transport. The EIS estimates the impacts from air emissions to be 1 emission-related fatality. The EIS estimates that the 24-year national transportation campaign would cause fewer than about 3 latent cancer fatalities among the public, and fewer under the preferred mostly rail scenario. Although many people would be exposed nationwide over a long campaign, the radiation dose to any exposed individual would be very low. In this context, DOE does not consider such impacts to be high. In addition, DOE does not know of a plausible mechanism under these circumstances by which low-income or minority populations could incur high and adverse impacts when the general public would not. Because there could be no disproportionately high and adverse impacts on any population, including low-income or minority populations, it is not necessary to examine the composition of the population along existing transportation corridors to conclude that potential public health effects from exposure to radioactive materials during routine transportation would not involve environmental justice concerns.

The EIS estimates the number of people in the general public who could be killed by accidents involving transportation of spent nuclear fuel and high-level radioactive waste. The two mechanisms for such impacts are bodily trauma from collisions or exposure to radioactivity that would be released if a sufficiently severe accident occurred. The EIS estimates that the 24-year national campaign would cause fewer than 5 deaths among the general public from trauma sustained in collisions with vehicles carrying spent nuclear fuel or high-level radioactive waste. In this context, DOE does not consider such impacts to be high. Moreover, DOE does not know of a plausible mechanism under these circumstances by which low-income or minority populations could incur high and adverse impacts when the general public would not.

Only if a severe accident occurred that resulted in release of radioactive materials would it be possible for the affected population to sustain high and adverse health effects, but the probability of such an event occurring is remote, so the overall associated risk to the general public would be low. Moreover, as is true of all transportation accidents, it is impossible to predict where along a transportation corridor an accident might occur (unlike accidents at fixed-facility locations), and, thus, who might be affected. Therefore, as with routine transportation and trauma effects of accidents, it is not necessary to examine the composition of the population along transportation corridors to conclude that the radiological risk resulting from transportation accidents would not constitute a disproportionately high and adverse impact on low-income or minority populations.

Although the transportation of radioactive materials would not result in disproportionately high and adverse impacts on low-income and minority populations, there are reasons to examine the composition of the population along newly proposed transportation corridors (such as the alternative locations of rail corridors within Nevada) that do not apply to existing highways and railways. When considering where to locate a new transportation corridor, the impacts of the construction and use of a newly created route on land use, socioeconomics, noise, air quality, and esthetics, to name a few categories, might vary by location. For example, constructing a new highway that might benefit the population as a whole might, nevertheless, so disrupt a minority or low-income population living along the proposed route as to result in disproportionately high and adverse impacts. Selecting among alternative new routes might offer opportunities to avoid high and adverse impacts that would fall disproportionately on low-income or minority populations in relation to the general population that would not be present when considering existing transportation corridors. Therefore, even though the health effects from exposure to radioactive materials from transportation activities would not involve environmental justice concerns in selecting new routes, other factors could. For these reasons, DOE examined the composition of the populations along the five alternative routes for a rail corridor in Nevada to determine the minority and low-income populations residing along the corridors.

In the EIS analyses, DOE assumed shipments would use highway routes that would comply with U.S. Department of Transportation regulations for transporting spent nuclear fuel. With the exception of routes to the nearest Interstate System highways or state or tribal designated preferred routes used to pick up shipments from generator sites and to deliver shipments to Yucca Mountain, Department of Transportation regulations require carriers to use Interstate System highways, bypasses, and beltways, or state or tribal designated preferred routes that reduce time in transit. DOE shipments would comply with these regulations.

8.8.3 (173)
Comment - 4 comments summarized
Commenters disagreed with DOE's analysis of impacts at generator facilities of loading spent nuclear fuel and high-level radioactive waste into shipping casks and delivering the casks to carriers for transport to Yucca Mountain. One commenter observed that DOE's estimate of 0.1 person-rem exposure to the public from loading spent nuclear fuel and high-level radioactive waste for transportation is much lower than impacts for other accidents analyzed in the EIS. The commenter asked what units of measure apply to the 0.1-person-rem impact – per year, per accident, per hour, average? The commenter suggested the estimate of 0.1 person-rem is based on experience to date but could be expected to increase as the quantities of spent nuclear fuel that are handled and loaded increase. This commenter disagreed with DOE's assertion that risks associated with handling and loading high-level radioactive waste would be less than those from handling and loading spent nuclear fuel.

A commenter stated that the Schneider report (DIRS 101747-Schneider et al. 1987) does not provide valid information for evaluating impacts of loading spent nuclear fuel at generator sites. The commenter argued the report did not consider a much different loading scenario in which storage casks (which at the time of the Schneider report

did not receive general certificates of compliance from the Nuclear Regulatory Commission) would be unloaded into transportation casks at generator sites.

A commenter stated DOE did not address risks of or procedures to transfer spent nuclear fuel and high-level radioactive waste from DOE or utilities to a carrier and must provide further analysis of waste transfer procedures, risks, modes among generators, carriers, and receiver.

A commenter observed that most accidents to date at nuclear powerplants have been industrial accidents, and asked what are DOE's grounds for asserting there would be no worker fatalities from industrial accidents in loading spent nuclear fuel for transport?

Response

Section 6.2.4.1 and Table 6-16 of the EIS provide a summary of information on the impacts associated with accidents of handling and loading spent nuclear fuel and high-level radioactive waste. DOE based its estimate of 0.1 person-rem per year to the onsite workforce, not the general population (see Table 6-16), on information presented in a report on health and safety impacts for the multipurpose canister system (DIRS 104794-CRWMS M&O 1994). This report estimated that impacts to members of the onsite workforce from a loading facility would be no more than 0.1 person-rem in the event of an accident in loading and handling a multipurpose canister system for transport. The collective dose to the public would be much less. This estimate is consistent with DOE estimates of offsite impacts from accidents at a monitored retrievable storage facility (DIRS 104731-DOE 1986). The estimated impact to workers and the public health and safety is for a single handling accident. DOE's estimate for the rate for lift-handling accidents involving spent nuclear fuel casks presented in Section 6.2.4.1 is 1 in 10,000 handling operations.

These dose risks would be lower than those for transportation accidents for several reasons. The forces involved with a handling accident would be much less severe than those postulated for the maximum reasonably foreseeable transportation accident. Handling accidents would occur inside nuclear facilities designed to protect the public from the consequences of handling accidents and much more severe reactor accidents. DOE used information from *Preliminary Preclosure Design Basis Event Calculations for the Monitored Geologic Repository* as the basis for projecting that handling accidents involving loading high-level radioactive waste for transportation would have lower consequences than those involving loading spent nuclear fuel (DIRS 103237-CRWMS M&O 1998).

DOE based its estimates of impacts of loading spent nuclear fuel and high-level radioactive waste on *Analysis of Radiation Doses from Operation of Postulated Commercial Spent Fuel Systems* (DIRS 101747-Schneider et al. 1987). The information in this report is based on analysis of loading procedures and risks among generators at commercial nuclear facilities for shipping spent nuclear fuel using truck casks and rail casks. DOE believes this report provides the latest reasonable information for estimating impacts of loading spent nuclear fuel and high-level radioactive waste at generator facilities. To estimate loading impacts, DOE assumed spent nuclear fuel and high-level radioactive waste would be available in locations where loading operations occur, for example storage pools at commercial nuclear reactors. DOE did not analyze the impacts of loading and unloading dry storage casks at nuclear facilities because these impacts are addressed in environmental analyses prepared by the Nuclear Regulatory Commission to support licensing of the independent storage facilities.

At present, DOE intends to purchase services and equipment from Regional Servicing Contractors who would perform waste acceptance and transportation operations. Operational protocols and procedures would be developed with each generator by Regional Servicing Contractors as part of the planning process to be completed prior to initiation of transport of spent nuclear fuel or high-level radioactive waste from generators to the repository. Section M.3 of the EIS contains more information on operational protocols required of the Regional Servicing Contractors.

Section 6.2.2.2 of the EIS presents an analysis of industrial safety impacts of loading spent nuclear fuel and high-level radioactive waste at generator facilities. Because the estimates suggested there would be a 1-in-50 chance (2-percent probability) of one fatality from an industrial accident for the mostly rail scenario and a 1-in-20 chance (5-percent probability) for the mostly legal-weight truck scenario over 24 years of the Proposed Action, the EIS concluded no worker fatalities from industrial accidents would be expected.

8.8.3 (174)
Comment - 21 comments summarized
Commenters questioned the relevancy of the 30-year safety record of transporting spent nuclear fuel and high-level radioactive waste cited in the EIS for predicting the safety of future shipments to Yucca Mountain. Reasons given by commenters included (1) the proposed number of shipments is unprecedented and (2) the types of casks, procedures, and protocols used in the past are not applicable to the Proposed Action. Commenters also questioned DOE's contention that the safety record is good, citing transportation accidents involving spent nuclear fuel and low-level waste (72 incidents from 1949 to the present according to a database at Sandia National Laboratories). Others argued that shipping casks have not yet been built and tested, so their performance is not yet known and the impacts of accidents cannot be judged. Commenters said that the EIS should have predicted accidents and described how they would be mitigated.

Commenters said DOE should use "shipment miles" rather than "number of shipments" as the measure for predicting safety, noting that the total number of shipment miles to date is very small compared to the total number of shipment miles associated with the repository. Some commenters stated that past shipments of spent nuclear fuel from a reactor's core to its storage ponds should not even be considered a "shipment."

Response
Sections J.1.1 and J.1.4.2.1 of the EIS present the approach DOE used to estimate the number of accidents and the associated impacts that would occur in transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain for the Proposed Action. As requested by public comments, DOE has included maps showing the routes used in the analysis and estimates of the state-by-state impacts based on these routes (see Section J.4). The approach, which is not based on the safety record of shipments of spent nuclear fuel over the past 30 years, uses U.S. Department of Transportation state-by-state accident and fatality statistics for highway, rail, and barge transportation. The statistics were compiled from accidents that occurred during all four seasons from 1994 through 1996 (DIRS 103455-Saricks and Tompkins 1999), which is the most current information of this type available. The approach includes the assumption that the number of potential accidents and impacts would be proportional to the number of total kilometers that shipments would travel in each state (number of cask shipments times distance traveled). Annual accident data were used and routes were assumed not to change with season. Thus, the number and impacts of accidents would be independent of the time of year travel would occur.

Total incident-free impacts for 24 years, which would be dependent on the total number of shipment kilometers, would not be affected by the time of year shipments were made if routes remained the same. Because accident rate data are not available for specialized logistical arrangements, such as convoys and dedicated trains, DOE assumed the industry-wide accident rates for individual truck, railcar, and barge shipments used in the EIS would apply. Because incident-free impacts would be proportional to the number of cask shipments over 24 years, transporting casks in multiples in convoys or dedicated trains would not affect these impacts. Because accidents at intermodal transfer facilities would not exceed cask design requirements, DOE estimated that radiological impacts would not occur for these (see Section J.3.3.1 of the EIS).

Section 6.3.3 of the EIS presents estimates for industrial safety impacts from operations at an intermodal transfer station in Nevada. In one area the approach for estimating the number and severity of accidents relied on historic experience. It assumed spent nuclear fuel and high-level radioactive waste would be properly packaged for shipment in Type B shipping casks certified by the Nuclear Regulatory Commission to comply with the performance standards contained in 10 CFR Part 71, as required by Commission and U.S. Department of Transportation regulations. Type A and strong-tight packaging, which are not accident-resistant (see 49 CFR 173.403), would not be used to ship spent nuclear fuel or high-level radioactive waste. The approach also assumed transport carriers' operations and vehicles would comply with applicable Federal, state, Native American tribal, and local regulations; occur during all four seasons of the year; and resemble those used for other commodities transported in interstate commerce. DOE would ensure that shipments of spent nuclear fuel and high-level radioactive waste to Yucca Mountain and the return of empty shipping casks and vehicles for further use would comply fully with applicable Federal, state, tribal, and local regulations, including those of the Nuclear Regulatory Commission and U.S. Department of Transportation (see Section 2.1.3.2). These regulations include, among other things, requirements for operator training, vehicle safety, records, communications and tracking, and security. These measures are implemented to minimize potential human errors and other conditions that could lead to accidents.

The analyses used "fatality" as the measure of impacts to the public because it is an easily understood objective measure used historically in EISs prepared by DOE. In response to public comments, DOE has included a discussion on the range of potential costs of cleanup following a severe transportation accident in Appendix J of the EIS. This discussion reviews costs for cleanup presented in past studies, including a report used in the 1986 Environmental Assessments (DIRS 154814-Sandquist et al. 1985), and information submitted by the State of Nevada in its comments on the Draft EIS. The information submitted by the State included estimates of cleanup costs as high as $9.4 billion. Cost data used in the studies included data compiled from case studies involving actual cleanup of radioactive material contamination. The studies addressed consequences for releases of radioactive materials in communities. In response to comments from the public, DOE has included additional information on Federal, state, tribal, and local responsibilities and preparedness for emergency response to accidents involving radioactive materials shipments (see Section M.5 of the EIS). Section M.8 discusses the Price-Anderson Act, which provides for indemnification for public liability to redress costs of accidents involving releases of radioactive materials to the environment or authorized precautionary evacuations.

8.8.3 (176)
Comment - 7 comments summarized
Commenters stated that because the EIS does not define floodplains within rail corridors, along heavy-haul truck routes, and at potential sites for an intermodal transfer station, the analysis of floodplains and wetlands in Appendix L is insufficient to support decisions to select a transport mode or route in Nevada.

Commenters said that wetlands, which some corridors are known to cross, are valuable resources in Nevada, and that it is not sufficient to simply state in the EIS that impacts to wetlands would be mitigated. Commenters also said that the floodplain information that is in the EIS has not been verified by ground surveys.

Commenters stated that the analysis of surface-water resources in the EIS is insufficient because it does not acknowledge that flooding and flash flooding can occur along parts of the rail corridors and along the heavy-haul truck routes. In wet years, parts of any rail line in Nevada could be covered with floodwater and these routes are not in an area that is appropriate for the shipment of spent nuclear fuel and high-level radioactive waste. Referring to DOE's commitment to temporarily stop shipments whenever flooding affected a route, commenters asked if these shipments would be parked and if a flash flood could be detected in time to stop a shipment before it was threatened by flood waters. Commenters stated that none of the candidate routes avoid designated groundwater basins. Other commenters said that flash floods entering Pahrump Valley from the Wheeler Pass area would require a large retention basin, and that the EIS did not address the impacts of this manmade structure.

Response
Sections 3.2.2.1.3 and 3.2.2.2.3 of the EIS present information concerning current conditions of potentially affected surface-water and groundwater resources along the candidate rail corridors, heavy-haul truck routes, and intermodal transfer station sites. Sections 6.3.2 and 6.3.3 identify potential impacts on surface-water and groundwater resources along each candidate route and site for an intermodal transfer station. Appendix L examines the effects on floodplains and areas that could have wetlands in Nevada of construction and operation and a branch rail line or intermodal transfer station associated with routes for heavy-haul trucks. The assessment in Appendix L did not evaluate potential floodplain or wetlands effects along highway routes because these existing roads should already be designed to meet 100-year floodplain design specifications. Appendix L states that if DOE decided to construct a branch rail line or use heavy-haul trucks in Nevada, a more detailed floodplain/wetlands assessment of the selected rail corridor or route for heavy-haul trucks and associated intermodal transfer station site would be prepared. However, DOE has added additional flood zone information to the floodplain/wetlands assessment in Appendix L. Specifically, the appendix now identifies 100-year flood zones crossed by rail corridors or their alignment variations if such information is available on maps published by the Federal Emergency Management Agency.

DOE would select the specific alignment within a corridor and design of a branch rail line or specific location and design of an intermodal transfer station to preclude flood water, including water from flash floods, from a 100-year flood from inundating rail track or facility operations areas. Engineering designs used as a basis for the EIS considered the potential for flooding along candidate routes and sites for an intermodal transfer station. The designs included culverts and bridges that would be needed to accommodate water from a 100-year flood.

If DOE decided to construct a branch rail line or an intermodal transfer station, it would require a hydrological analysis and evaluate the impacts of designing for floods for 25, 50, and 100 years. Critical areas might require the design to address a 100-year storm, based on appropriate engineering criteria.

As stated in the *Manual for Railway Engineering*, "The design flood frequency to be used is a matter of engineering judgement and economics. A number of trials should be made using a wide range of frequencies. In this way the possibilities of damage because of too small an opening can be assessed. The cost of providing for the maximum possible flood of 100 years frequency or greater can also be determined and a prudent decision made. In general practice, railroad drainage openings should be designed for floods in the range of 25 to 50 years. This does not imply that a 100-year flood design would be out of place in certain instances" (DIRS 106860-AREA 1997).

Disturbed area estimated in Chapter 6 of the EIS for each candidate branch rail line, highway route for heavy-haul trucks, and site for an intermodal transfer station includes areas for retention basins and engineered flow channels. DOE would temporarily discontinue shipments of spent nuclear fuel or high-level radioactive waste that would use a highway or rail route where flooding could compromise safety. Shipments that were underway at the time of an ongoing or potential flooding event would be temporarily delayed at a safe, secure location along the route until the affected section of track, roadway, or intermodal transfer station was determined to be safe for use. DOE would monitor weather forecasts to ensure shipments would not occur in areas where, and at times when, the potential for flash flooding could compromise safety.

Groundwater basins underlie all areas of Nevada including areas where shipments would travel. Designated groundwater basins identified in Chapter 6 of the EIS are basins for which the Nevada State Engineer has determined that permitted water rights approach or exceed the estimated perennial water or that additional administrative oversight is required. Designated Groundwater Basins are identified to provide information regarding availability of groundwater needed for constructing a branch rail line or upgrading highways for use by heavy-haul trucks. As described in Section 6.3 of the EIS, DOE would transport water by truck to construction areas if it could not obtain permits for withdrawals from a Designated Groundwater Basin.

Chapter 9 of the EIS, which provides DOE's initial list of mitigation commitments available at this time, identifies DOE-determined impact reduction features, procedures, and safeguards and mitigation measures under consideration for inclusion in the project plan and design. Chapter 9 also identifies ongoing studies that could eventually influence mitigation measures related to the project plan and design. For example, Section 9.3 discusses mitigation measures to reduce potential impacts from the transportation of spent nuclear fuel and high-level radioactive waste nationally and in Nevada. These measures address impacts from the possible construction of a branch rail line or an intermodal transfer station in Nevada; construction of other transportation routes; upgrading of existing Nevada highways to accommodate heavy-haul vehicles; transportation of spent nuclear fuel and high-level radioactive waste from existing storage sites to the proposed repository; and fabrication of casks and canisters. As suggested Chapter 6 and Section 11.2.2 (subsection on Compliance with Floodplain/Wetlands Environmental Review Requirements), more detailed field surveys, government consultation, analyses, and appropriate National Environmental Policy Act reviews would be conducted if a decision was made to select a specific rail alignment within a corridor or a specific location of an intermodal transfer station or the need to upgrade the associated heavy-haul truck routes. These would include consultations with State wildlife management agencies, the Bureau of Land Management, the Army Corps of Engineers, and other applicable government agencies. They also would include field surveys (as applicable) and more detailed assessments and analyses of wetlands and other waters; floodplains; sensitive species; effects of habitat fragmentation, interruption of movements, mortality, and harassment on wildlife, horses, and burrows; loss of hunter-generated revenue, spread of noxious weeds, and soils.

8.8.3 (177)
Comment - 8 comments summarized
Commenters stated that the EIS is inadequate because it did not consider the effects of the proposed Private Fuel Storage facility in Skull Valley, Utah, on transportation of spent nuclear fuel to Yucca Mountain. Commenters expressed concern that utilities would ship their older commercial spent nuclear fuel currently in storage to the Private Fuel Storage facility (if it is licensed), before a repository at Yucca Mountain was constructed. Therefore, at a later date, much younger and more radioactive spent nuclear fuel from commercial facilities would be shipped to the Yucca Mountain Repository. Commenters argued that DOE's Acceptance Priority Ranking (DIRS 104382-DOE 1995) did not consider the Private Fuel Storage facility in determining the order in which spent nuclear fuel would

be delivered to Yucca Mountain. Commenters stated that NUREG-1437 (DIRS 101899-NRC 1996 and DIRS 101900-NRC 1996) states that the minimum cooling time for transporting spent nuclear fuel is 5 years; however, the Draft EIS used a cooling time of 25.8 years to assess health impacts. Based on this information, the cooling time for spent nuclear fuel used in the EIS analysis of impacts should be much less than 25.8 years.

Commenters stated that the Private Fuel Storage facility and the Yucca Mountain Repository would likely be used together and the Private Fuel Storage facility could become a clearinghouse for spent nuclear fuel. This would mean that Utah could become the state of origin for more than half of the commercial spent nuclear fuel shipped to the Yucca Mountain site. The combined transport for the Private Fuel Storage facility and the Yucca Mountain Repository would be greater than that estimated in the Draft EIS, resulting in more shipment miles. This would cause a greater hazard than that reported in the Draft EIS. Commenters stated that impacts in Utah would be much greater than that estimated in the Draft EIS because of the combination of shipments to both the Private Fuel Storage facility and to Yucca Mountain. As a consequence, there would be a major impact on a national scale that would need to be assessed in the analysis of cumulative impacts. Failure to consider the Private Fuel Storage facility would segment the National Environmental Policy Act process. Commenters stated that Utah deserves special consideration in the EIS, similar to that given Nevada, because 92 percent of the spent nuclear fuel would be transported through the State and the Private Fuel Storage facility would be located there. The Draft EIS is inadequate because specific information for routes in Utah were not considered in the estimate of health and economic impacts from the transport of spent nuclear fuel and high-level radioactive waste. Commenters observed that heavy-haul trucks could be used to transport spent fuel casks to and from a rail line near the Private Fuel Storage facility, and stated that the EIS was deficient because it did not address the use of heavy-haul trucks in national transport of spent nuclear fuel to the Yucca Mountain site.

Response

On the basis of public comments that DOE received and the issuance of a draft EIS by the Nuclear Regulatory Commission, DOE determined that the proposed Private Fuel Storage, LLC, facility is a reasonably foreseeable future action whose impacts would be cumulative with those of the Proposed Action. Because licensing, construction, and operation of a private facility for storage of spent nuclear fuel would not be actions undertaken by DOE, the cumulative impacts, including potential affects on transportation impacts presented in Chapter 6, are included in Chapter 8 of the Yucca Mountain EIS. Impacts of constructing and operating a private storage facility, including impacts of transporting spent nuclear fuel from generator sites to the facility, are included in an EIS prepared and issued by the Nuclear Regulatory Commission (DIRS 152001-NRC 2000).

Based on public comments, DOE has revised the spent nuclear fuel used in the transportation analysis to spent nuclear fuel with less cooling time [15 years rather than 26 years and fuel with higher activity (50,000 megawatt-days per metric ton of heavy metal [MTHM]) versus 40,000 megawatt-days per MTHM]. The radionuclide inventory contained in spent nuclear fuel is presented in Appendix A of the EIS.

Section J.4 of the EIS presents maps showing the routes in each state, including Utah, used in the analysis of impacts of transporting spent nuclear fuel and high-level radioactive waste from generator sites to Yucca Mountain. This section also presents estimates of the impacts in each state for the routes used in the analysis. The impacts in each state were estimated using information such as projected number of shipments, along-route populations; route lengths in urban, suburban, and rural areas; and state-specific accident rates.

Based on information it has developed and information from other sources, DOE believes the mostly rail scenario described in the EIS would most closely approximate the actual mix of truck and rail shipments of spent nuclear fuel and high-level radioactive waste to a Yucca Mountain Repository. DOE considered whether sites are able to handle larger (rail) casks, distances to suitable railheads, and historic precedent in actual shipments of fuel, waste, or other large reactor-related components. It also considered relevant information published by knowledgeable sources such as the Nuclear Energy Institute and the State of Nevada. In addition, based on this information, DOE believes the mostly legal-weight truck and mostly rail scenarios bracket the range of reasonable mixes of truck and rail transportation. Furthermore, DOE believes this range of the possible mix of transportation modes that could be used is a sufficient basis for estimating the range (lower and upper bound) of potential environmental impacts from the transportation of spent nuclear fuel and high-level radioactive waste.

DOE has estimated the characteristics of commercial spent nuclear fuel that would be delivered to a Yucca Mountain Repository under the Proposed Action. For the purpose of the EIS, DOE did not have additional information it could use to estimate how shipments to a private storage facility might affect the characteristics of shipments to Yucca Mountain and potential changes in impacts from those presented. DOE agrees that use of the Private Fuel Storage facility could result in different schedules for shipping specific spent nuclear fuel to Yucca Mountain. However, if younger spent nuclear fuel was shipped to Yucca Mountain in early shipments because older spent nuclear fuel was shipped to Private Fuel Storage, older spent nuclear fuel would be shipped to Yucca Mountain in later years. Thus the cumulative impacts of transportation would be similar. DOE would evaluate information that became available to determine if shipments to a private facility would affect the results presented in this EIS. If DOE determined changes could be significant, it would perform additional National Environmental Policy Act evaluations and determine appropriate actions to be taken.

8.8.3 (205)
Comment - 5 comments summarized
Commenters noted that DOE used 25.9 years and 27.2 years for the respective ages of pressurized-water reactor and boiling-water reactor spent nuclear fuel that would be transported to Yucca Mountain. They suggested that a more realistic and conservative assumption would be 5 to 26 years to analyze the consequences of severe transportation accidents and successful acts of terrorism. Commenters said that the Nuclear Regulatory Commission approved shipments of 5-year Cooled spent nuclear fuel with up to 5-percent enrichment and 62,000 megawatt-days per metric ton uranium burnup. Commenters cited information from the DOE Statement of Position, Waste Confidence Proceeding, April 15, 1980 to argue that the single most important determinant of radiological risk is the cooling time for spent nuclear fuel. Commenters suggested the analyses should use bounding parameters for enrichment, cooling time, and burnup of spent nuclear fuel. Commenters expressed concern that exposures estimated in the EIS were based on 26-year-old spent nuclear fuel and that exposures would exceed the EIS estimates if 10-year-old fuel was shipped. Accidents and incidents involving 5-year-old fuel could have radiological consequences 5 to 10 times higher than those reported in the EIS.

Response
DOE has revised its description of spent nuclear fuel characteristics. As discussed in Section A.2.1.5 of the EIS, the revised spent nuclear fuel characteristics are

- Pressurized water reactor -- 15 years old, 50 megawatt-days per metric ton of uranium of burnup, 4.5 percent enrichment

- Boiling water reactor -- 14 years old, 40 megawatt-days per metric ton of uranium of burnup, 3.5 percent enrichment

DOE derived these characteristics through a dose-based hazard index analysis using the radionuclide inventory of the spent nuclear fuel assemblies and the screening models in *Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground* (DIRS 101882-NCRP 1996). These screening models account for all exposure pathways.

Accidents modeled with these spent nuclear fuel characteristics provide a conservative estimate of the impacts of transportation accidents. While some fuel could be slightly more radioactive, most would be considerably less radioactive.

8.8.3 (2453)
Comment - EIS000679 / 0002
We said ship the oldest fuel first. It has the smallest amount of gamma neutron radiation. It's the safest from a transportation standpoint.

DOE has not only made no commitment to do this, they've actually put some scenarios in their DEIS where they have to ship hotter, more dangerous fuel in order to get hot fuel to Yucca Mountain to heat up the repository horizon.

Response
The fuel that can be shipped by the utilities is dictated by the provisions of the Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste (10 CFR Part 961). In order to be considered "Standard Fuel" under the contract, spent nuclear fuel must have been cooled for at least 5 years.

DOE is required by the terms of 10 CFR Part 961 to assign priority to those waste generators whose spent nuclear fuel was discharged earliest. This is usually called the "Oldest Fuel First" priority. At sites designated by the generators who own the oldest spent nuclear fuel, DOE must pick up fuel the generators have selected and that has been cooled for at least 5 years.

Regardless of which fuel is shipped first, it would be done safely in casks certified by the Nuclear Regulatory Commission for that type of fuel.

8.8.3 (2499)
Comment - EIS010294 / 0009
Explain how and where the Heavy Haul Shipping Casks are loaded. Current Spent Fuel [Buildings] have limits on cask size. Define the limit for all existing nuclear stations.

Response
The mostly rail scenario in the Final EIS assumes that DOE and the Navy would transport most of the spent nuclear fuel and high-level radioactive waste to Nevada by rail, with the exception of material from commercial nuclear generating sites that initially would not have the capability to load large-capacity rail shipping casks. Those sites would use legal-weight trucks to ship material to the repository. Commercial sites with the capability to load the rail shipping casks but without rail access could use heavy-haul trucks or barges to ship spent nuclear fuel to the nearest rail line.

At this time there is no rail access to the Yucca Mountain site. This means that material traveling by rail would have to continue to the repository on a new branch rail line or be transferred to heavy-haul trucks at the intermodal (that is, from rail to truck) transfer station in Nevada and then travel on existing highways.

Section 6.2.2 of the EIS describes the potential impacts from loading spent nuclear fuel and high-level radioactive waste in transportation casks and onto transportation vehicles at the 72 commercial and 5 DOE sites.

8.8.3 (3428)
Comment - EIS001160 / 0126
The FEIS should consider the changing demographics of "snow-birds".

Response
The Final EIS used population estimates based on U.S. Census data and projected the population growth along transport routes to 2035. Because the Census only counts people at their permanent residences, the effect of seasonal relocation of population ("snowbirds") is not included in the analysis. However, the analysis does assume that individuals are in their places of residence when each shipment passes. Thus, while individuals who relocated into an area through which shipments passed are not included in the Census for the area, those who would temporarily relocate from another area through which the shipments passed are included even though they would reside elsewhere at the time. Thus, the analysis is balanced, counting some who would not be along a route when shipments pass as well as not counting some who would ("snowbirds").

8.8.3 (5872)
Comment - EIS001803 / 0002
My concern about the transportation of nuclear waste is based largely on a brief career that I had several years ago. I got a job selling railroad salvage, and while I only worked at that job for a few months, I clearly remember the enormous amount of salvage that we handled. One day I asked my boss whether our business was really based on railroad salvage or was this simply a way to push goods that some company wanted to sell cheap. I was assured that the items we sold were indeed railroad salvage items. At that time I was told that there was an average of 14 to 20 accidents per week in our catchment area which, I believe, was a two-state area. The public didn't hear about these

accidents because they were not newsworthy; a crate falling off a flatcar when a car hit an uneven piece of track, a car being derailed in an unpopulated area or merchandise being damaged when one rail car slammed into another.

Since the rail tracks that run through our communities and neighborhoods are even older now and since other forms of transportation have become more popular than rail, leaving the railroad industry financially unhealthy, I cannot imagine that our rail system is in better shape now than it was then. And while the entire DOE may work hard to keep the initial nuclear load from having an accident, what about the future?

You know as well as I that while there is much ado about this initial train trip, the time will come when the transportation of nuclear waste will not even be a blip on our radar screen. Nuclear waste transported once will become an acceptable activity because after the first trip, rail transportation will have become considered an acceptable form of transportation for nuclear waste.

Response
Rail transportation is an acceptable form of transportation for spent nuclear fuel. Of the thousands of shipments completed over the last 30 years, much of it by rail, none has resulted in an identifiable injury through the release of radioactive material. DOE would work with the railroad companies to determine routes based on safety, best available trackage, schedule efficiency, and cost-effectiveness. This includes selecting routes that result in minimum time in transit, minimum interchanges, and maximum use of mainline tracks.

In 1991 the Federal Railroad Administration established an enhanced inspection policy for rail movements of spent nuclear fuel and high-level radioactive waste. This policy sets forth enhanced inspection criteria for use by Federal Railroad Administration inspectors. It requires, for example, the entire track and signal system be inspected along the designated route prior to the initial movement. Follow-up inspections for track, signal systems and operating practices would be conducted on a 6-month basis, unless information is obtained that might dictate that follow-up inspections be conducted more (or less) frequently.

8.8.3 (5992)
Comment - EIS001879 / 0018
The Draft EIS underestimates the radiological risk of routine transportation over a 30-40 year campaign of shipment through rural communities along US-95 in the site county. The factors that contribute to the underestimation include: 1) a larger proportion of current resident and workforce population is closer to the shipment route than is assumed in the EIS; 2) more current and potential future population (lodging visitors, school children in busses, pedestrians) is exposed to routine transportation than is assumed in the EIS; 3) the average shipment speed in through these communities is slower than assumed in the EIS.

As it did for the Draft EIS, Nye County offers to work with DOE in a revised analysis to develop measures that more correctly reflect local conditions in the affected Nye County communities.

Response
To address the issue of local conditions within Nye County, the EIS has been revised based on comments to use Nye County population data extrapolated to 2035 to estimate the transportation impacts of the Proposed Action (see Section 3.1.7 of the EIS).

In addition, the EIS has been revised based on comments to include impacts representative of impacts in small communities along transportation routes, such as are in Nye County. This analysis accounts for factors such as the location of people, slower speeds of shipments, locations of intersections, commercial establishments and residences, and traffic signals (see Sections 6.3.1, 6.3.2, 6.3.3, and J.1.3.2.2.1 of the EIS).

8.8.3 (6287)
Comment - EIS001727 / 0006
Let me start by saying that it's sad that they don't know their document well enough to have answered Kay Drey's question about the curies in a cask. This is on page J-36, Table J-14 of Appendix J. You'll find that a rail cask loaded with typical commercial fuel has a total of 2,000,000 curies, 800,000 of which are Cesium 137. Actually, that's an optimistic assessment because that assumes the fuel has been cooled for 26 years. We believe a lot of this

fuel will only have been cooled five to ten years, and one ten-year cooled assembly from a pressurized water reactor -- remember, they're going to ship several hundred thousand of these -- just one of those assemblies has enough Strontium-90 to contaminate all the water in Lake Mead, which is 23 trillion gallons in a good year, to twice the EPA [Environmental Protection Agency]-allowable drinking water standards, so we're talking about very hazardous radiological materials here, materials that if I had been here standing next to an assembly for, what, three minutes now, I'd already have a lethal dose of radiation, so this is even after the materials have been cooled down from the reactor for 10 years, or even 26 years as the DOE assumes, very dangerous.

Response
Spent nuclear fuel and high-level radioactive waste are transported in very robust casks, designed to withstand the impact forces and fires that could occur with very severe transportation accidents. Furthermore, the casks are designed to be watertight following severe accidents. Numerous tests and extensive analyses, using the most advanced analytical methods available, have demonstrated that casks would provide containment and shielding even under the most severe kinds of accidents that occur. A study completed by Sandia National Laboratories for the Nuclear Regulatory Commission (DIRS 152476-Sprung et al. 2000) concluded that casks would continue to contain spent nuclear fuel in more than 99.99 percent of all accidents. See Section M.4 of the EIS for additional information on the safety and testing of transportation casks.

Spent nuclear fuel and high-level radioactive waste are not easily dispersed; they do not dissolve in water; they are not liquids or gasses that can be easily spilled or leaked, and, with the exception of a very small, nearly undetectable effect, radiation from them does not make other materials radioactive. Spent nuclear fuel and high-level radioactive waste are solids. They are hard, tough, and dense ceramics, metals, or glasses contained within tough metal barriers.

The radionuclide inventory contained in spent nuclear fuel is presented in Appendix A of the EIS.

Unshielded spent nuclear fuel can be hazardous and for this reason spent nuclear fuel is shipped in heavily shielded casks. The maximum radiation dose rate from a spent nuclear fuel cask is about 10 millirem per hour at 2 meters (6 feet) from its transporting vehicle. For perspective, the radiation dose from a single chest X-ray is about 8 millirem. Therefore, the radiation dose from standing 2 meters away from a shipment of spent nuclear fuel for 1 hour would be equivalent to a little more than one chest X-ray, and much lower than a lethal radiation dose.

8.8.3 (6568)
Comment - EIS001632 / 0056
Page 6-17, Section 6.1.3, second paragraph: The next-to-last sentence says that "an air quality conformity analysis [for carbon monoxide] may be required." If a conformity determination is needed, it should be made before completion of the NEPA [National Environmental Policy Act] process. EPA [Environmental Protection Agency] suggests such information be included in the final EIS.

Response
The Conformity Review discussions have been updated in all sections. Conformity Review results are summarized in Section 6.3.1.1 of the EIS for the mostly legal-weight truck scenario, in Section 6.3.2.1 for the mostly rail scenario, and in Section 6.3.3.1 for the heavy-haul truck scenario. The Conformity Review was focused on with levels of carbon monoxide and particulate matter (PM_{10}), for which the Las Vegas air basin has been classified as being in "serious nonattainment." Since the Draft EIS was published, the mostly rail scenario has been selected by DOE as the preferred transportation option. The Conformity Review found that more detailed analyses (that is, a Conformity Determination) would be required for the construction phase of a branch rail line in the Valley Modified Corridor, if that rail corridor was selected. The other corridors would not present a conflict with the General Conformity requirements for carbon monoxide and PM_{10}. Emissions for constructing a branch rail line in the Valley Modified Corridor are estimated in the Conformity Review to be up to 145 metric tons (160 tons) per year (160 percent of the General Conformity threshold level) for carbon monoxide, and up to 120 metric tons (130 tons) per year (190 percent of the General Conformity threshold level) for PM_{10}.

The carbon monoxide emissions within the nonattainment area would result from fuel use by the construction vehicles and vehicle emissions from commuter and supply traffic to the Yucca Mountain site. The PM_{10} releases would include the emissions from disturbing the ground and from fuel combustion of the construction equipment. Dust abatement measures (for example, water applications) would reduce fugitive dust PM_{10} emissions by

70 percent. The emissions estimates could be reduced further by lengthening the construction time or more detailed task planning to reduce the production of emissions.

Emissions from a branch rail line in the Valley Modified Corridor into the nonattainment area would occur during the much longer operations phase, as the locomotive passed through the nonattainment area on its way to the Yucca Mountain site. However, operations phase emissions would not exceed the General Conformity threshold levels. The estimated operations emissions for a branch rail line in the Valley Modified Corridor would be 81 percent of the carbon monoxide General Conformity threshold level and less than 3 percent of the PM_{10} General Conformity threshold levels.

In addition, the Conformity Review compared the Valley Modified Corridor carbon monoxide and PM_{10} release estimates to the Nevada carbon monoxide and PM_{10} State Implementation Plans (DIRS 156706-Clark County 2000; DIRS 155557-Clark County 2001). The construction phase Valley Modified carbon monoxide emissions estimates would be less than 0.2 percent of the total daily carbon monoxide inventory emitted into the nonattainment area. The construction phase Valley Modified PM_{10} emissions estimates would be less than 0.08 percent of the daily and annual PM_{10} inventory emitted into the Las Vegas Valley air basin.

8.8.3 (7219)
Comment - EIS010270 / 0007
Movement of large concentrations of radioactive materials may interfere with normal sub-atomic atmospheric dynamics to the extent of causing weather and climate extremes. While radioactive atomic and molecular gases have been suggested as agents of weather and climate change in work such as "Meteorological Consequences of Atmospheric Krypton-85" (SCIENCE, vol. 193, #4249, 7/16/76), sub-atomic radioactive interactions and their effects in the field (rather than the lab) are just beginning to be explored. The physics sub-atomic world of "strings," etc. is like the biology sub-viral world of "prions." Mad Cow disease (and possibly AIDS, another "wasting" disease) are poorly understood, but real nevertheless. We ignore "prions" at our peril. I think that we should not ignore the possibility that the cloudburst that drenched the three trucks here in St. Louis last week was an effect of the movement of the material. It is anecdotal, but real, that in the last three years nearly all local tornadoes have formed over the Weldon Springs nuclear storage dump where truckloads of radioactive materials from downtown St. Louis and from the airport have moved during that time. Energetic actions at a distance are the meat of modern physics. We should be looking at the pragmatic energetic effects of the movement of these immensely energetic radioactive materials, before moving huge amounts of them.

If due to tangible dangers the materials must be moved, then I would suggest as a precaution moving the materials at night and during the winter months when the atmosphere is less energetically active - and on a sparsely populated route.

Response
DOE believes that the EIS adequately analyzes the environmental impacts that could result from either the Proposed Action or the No-Action Alternative. This belief is based on the level of information and analysis, the analytical methods and approaches used to represent conservatively the reasonably foreseeable impacts that could occur, and the use of bounding assumptions where information is incomplete or unavailable, or where uncertainties exist. As the commenter stated, the meteorological phenomena described are in an early stage of observation, are poorly understood, and are not predictable. Therefore, the data and analytical methodologies that could be used for an analysis are not available and DOE has not addressed it in its analysis.

However, DOE would consider all aspects of safety in transporting spent nuclear fuel and high-level radioactive waste. Shipments of spent nuclear fuel and high-level radioactive waste to a Yucca Mountain Repository would comply with all applicable regulations and accepted standard practices to help ensure their safely. In addition, as described in Appendix M of the EIS, the Department would require its contractors to follow "Operational Protocols," which provide additional measures to enhance safety in transporting radioactive materials, including requirements for transportation under inclement weather conditions. In addition, DOE plans to require that each shipment be tracked and continuously monitored using a satellite-based tracking system. Routes that would be used would comply with U.S. Department of Transportation regulations that prescribe how routes are selected for highway shipments and railroad industry practices that emphasize use of main-line track, shortest transport distance, and fewest interchanges between railroads. Routes would be approved by the Nuclear Regulatory Commission to

ensure that transportation safeguards and security objectives and requirements specified in 10 CFR 73.37 would be satisfied.

8.8.3 (7230)
Comment - EIS001337 / 0107
Page 4-88 Section 4.1.15.4. Sites for cask manufacturing should have been considered within Nevada. The FEIS should consider sites along transportation corridors in Nevada. The description of environmental setting for these facilities belongs in Section 3, Affected Environment.

Response
DOE would not develop transportation casks, but plans to contract with the private sector to provide waste acceptance and transportation services, including equipment. All cask designs must contribute to overall efficiency and operability of the entire transport systems and meet Nuclear Regulatory Commission regulations. Information on the process for acquisition of waste acceptance and transport services, including casks, through the Regional Servicing Contractors is provided in Section M.3.1 of the EIS.

Because there are existing manufacturing facilities that could meet the projected manufacturing requirements, the EIS assumed that new cask manufacturing facility construction would not be necessary and that there would be no change in land use for the manufacture of disposal containers and shipping casks. Therefore, it was not necessary to consider manufacturing sites in Nevada.

8.8.3 (7789)
Comment - EIS002093 / 0002
I'm disappointed that the DEIS largely characterizes potential waste management systems impacts in Nevada as insignificant, generally positive in terms of job creation or both. If transportation through and disposal of waste within Nevada is such a benign activity, then why is no other state in the nation willing to host a facility like Yucca Mountain? The DEIS should answer this by way of a more thorough and fair assessment of impacts, including stigma.

Beyond its deficient approach to treating equity between Nevada and the rest of the nation, the DEIS does not provide sufficient treatment of the distribution of radioactive waste transportation risks among Nevada's urban and rural communities. In 1975, Governor O'Callaghan, State Senator Richard Bryan and their respective colleagues formally requested this activity come to Nevada with one particular caveat, that transportation avoid the Las Vegas Valley.

Today Nevada's governor and congressional delegation have made clear their intent to restrict shipments of nuclear waste from highways in Nevada's urban centers. Rather, Nevada's leaders see it as in Nevada's best interest to shift transportation related risk to rural counties and communities. As a consequence, low-level radioactive waste is now and spent nuclear fuel and other high-level radioactive waste in the future will be shipped through Nevada's rural counties and communities on its way to the Nevada Test Site.

I find it ironic that just a few years ago a suggestion by Lincoln County and City of Caliente officials to avoid shipments through the Las Vegas Valley resulted in the Nevada Attorney General seeking to throw several of my colleagues and I out of office.

Response
The Nuclear Waste Policy Act, enacted by Congress in 1982 and amended in 1987, has set forth a process that requires the Secretary of Energy to undertake site characterization activities at only one site, Yucca Mountain, Nevada. An analysis of impacts associated with transportation in Nevada can be found in EIS Section 6.3. The routes analyzed in Section 6.3 represent the reasonable alternatives consistent with National Environmental Policy Act provisions, and include routes that travel through both urban and rural areas of Nevada. The use of Interstate System highways and beltways is mandated by U.S. Department of Transportation routing guidelines. State or tribal routing agencies may designate preferred routes within their jurisdictions in accordance with 49 CFR 397.103. If such routes are designated and they can be used in a manner that complies with the requirements of regulations of the Department of Transportation and the Nuclear Regulatory Commission, DOE would use them. The State of Nevada has not designated preferred routes within the State. However, DOE performed sensitivity analysis that

analyzed the impacts of using potential alternate routes identified in a report prepared for the Nevada Department of Transportation. The analysis evaluated the impacts in Nevada and the remainder of the nation for six alternate routes for legal-weight truck shipments within Nevada, including highway routes through rural areas (see EIS Section J.3.1.3.).

In light of the comments received on the Draft EIS concerning perceived risk, DOE examined relevant studies and literature on perceived risk and stigmatization of communities to determine whether the state-of-the-science in predicting future behavior based on perceptions had advanced sufficiently since scoping to allow DOE to quantify the impact of public risk perception on economic development or property values in potentially affected communities (see Section 2.5.4 and Appendix N of the EIS). Of particular interest were those scientific and social studies carried out in the past few years that directly relate to either Yucca Mountain or to DOE actions such as the transportation of foreign research reactor spent nuclear fuel. DOE reevaluated the conclusions of previous literature reviews such as those conducted by the Nuclear Waste Technical Review Board and the State of Nevada, among others. DOE has concluded that:

- While in some instances risk perceptions could result in adverse impacts on portions of a local economy, there are no reliable methods whereby such impacts could be predicted with any degree of certainty
- Much of the uncertainty is irreducible, and
- Based on a qualitative analysis, adverse impacts from perceptions of risk would be unlikely or relatively small.

While stigmatization of southern Nevada can be envisioned under some scenarios, it is not inevitable or numerically predictable. Any such stigmatization would likely be an aftereffect of unpredictable future events, such as accidents, which would not be expected to occur. As a consequence, DOE addressed but did not attempt to quantify any potential for impacts from risk perceptions or stigma in this Final EIS.

8.8.3 (8849)
Comment - EIS000869 / 0021
Paragraph three [of Section S.4.2.2] involves an intermodal transfer station. Caliente and Jean are both located near existing or planned correctional facilities. Any radiation exposure, intentional or accidental, to employee or inmate populations of these facilities could result in cruel and unusual punishment and potentially skyrocketing legal costs for the counties, state, and federal governments.

Response
The average radiation dose to a person residing within 800 meters (0.5 mile) of a transportation route was estimated to be less than 0.1 millirem over 24 years. For perspective, the average background radiation dose is about 300 millirem per year and the Environmental Protection Agency radiation dose limit for members of the public from all manmade sources of radiation is 100 millirem per year. A dose of 0.1 millirem would increase the risk of a latent cancer fatality over a person's lifetime by about 1 in 20 million. Therefore, health and safety impacts to an individual from a dose of 0.1 millirem over 24 years would not be discernible.

8.8.3 (8972)
Comment - EIS002127 / 0013
Radiation release causes health risk and contaminates the highway surface and the surrounding area. Using your own DOE accident and incident data, Clark County estimates that forty such incidents of surface contamination will occur within Clark County for the proposed action of this DEIS and that three incidents of radioactive contamination beyond the vehicle will occur. These figures are only within Clark County. The response to all such accidents and incidents must be addressed by the DEIS.

Response
DOE has reviewed the potential for contamination of the transport vehicles and beyond during spent nuclear fuel and high-level radioactive waste cask transportation and does not consider it a significant threat. Minor surface contamination of spent nuclear fuel casks is well understood and controllable through the use of conventional operational practices.

Surface contamination of spent nuclear fuel casks would usually be due to cask weeping. The phenomenon of cask weeping can be described as follows: a cask that has been loaded or unloaded in a spent nuclear fuel storage pool becomes contaminated with radioactivity on its surface. Before shipment, the external surface of the cask is decontaminated to levels specified by regulations, but when the cask is inspected on arrival at its destination, contamination above the levels allowed by regulations is sometimes found. It is believed that when a cask is repeatedly placed into water-filled spent nuclear fuel storage pools, it becomes increasingly contaminated over time, with the contamination penetrating deeper into the cask's surface. Routine decontamination, which removes surface contamination, is sometimes not sufficient to remove contamination that has migrated deeper into the surface. As a consequence, if decontamination prior to shipment is not aggressive enough, during transportation the level of surface contamination can increase as deep contamination weeps out of the cask's surface.

The levels of contamination associated with the weeping phenomenon are not high enough to be factored into the risk assessment for transportation. Operational procedures would be used to preclude this problem during shipments. For example, wrapping the cask in plastic before entry into spent nuclear fuel storage pools is an effective practice that is often used. Therefore, contamination weeping is not expected to be a significant contributor to risk during spent nuclear fuel transportation.

The EIS has been revised to describe the maximum reasonably foreseeable accident in terms of accident conditions such as impact velocities and fire durations as well as the failure mechanisms that could lead to releases of radioactive materials from a cask. "Real-life conditions" that would involve various types of collisions and associated impact velocities, natural disasters, specific locations (such as mountain passes), or various infrastructure accidents (such as track failure) in effect constitute a combination of events that could lead to failure of a cask to contain spent nuclear fuel or high-level radioactive waste fully. Thus, DOE has reflected real-life accident situations and conditions in its analyses.

States and tribes are primarily responsible for the health and safety of their citizens. However, in the event of an accident that released radioactive materials, a state or tribe could request assistance from Federal agencies under the Federal Radiological Emergency Response Plan and Federal Radiological Monitoring and Assessment Plan. DOE has several assets that could assist, including the Radiation Emergency Assistance Center/Training Site (REAC/TS). REAC/TS is on call 24 hours a day to provide direct or consultative help with medical and health physics problems associated with an accident or incident involving radioactive materials.

8.8.3 (9424)
Comment - EIS001888 / 0115
The DEIS failed to examine the likely interaction of the Yucca Mountain Program and other federal activities in Nevada. For example, while Clark County is in non-attainment for National Ambient Air Quality Standards (NAAQS), the DEIS did not mention the potential impact of the addition of heavy haul or legal weight trucks into the transportation system.

Response
Sections 8.2 and 8.4 of the EIS address the cumulative short-term impacts during construction, operation and monitoring, and closure of the repository and transportation in relation to other Federal activities in Nevada. Cumulative impacts on air quality also are addressed.

In response to comments, the EIS includes an expanded discussion of the potential impacts of increased truck and rail traffic on air quality in the Las Vegas Valley. Based on additional analysis and revised data, DOE has determined that an air quality conformity analysis and determination would not be required as a result of increased traffic in the Las Vegas Valley due to workers commuting between the Las Vegas area and the proposed repository at Yucca Mountain or the transportation of materials other than spent nuclear fuel and high-level radioactive waste. This modification was made to the EIS (see Sections 6.1.3, 6.3.2, and 6.3.3).

8.8.3 (9649)
Comment - EIS001888 / 0313
The DEIS' analysis of the human health risks of transporting waste through Clark County is insufficient. The DEIS understates the risks because of a failure to realistically describe the population of the affected area. Specifically, the

DEIS underestimates the current population of Clark County, the likely size and direction of population growth in Clark County, and the specific sensitive populations.

The DEIS defines the affected population as those Clark County residents living within .5 miles of the route. Unfortunately, the DEIS relies on 1990 census data, although data that is more current was available. The most current demographic information was readily available from a number of different sources in the county and should have been consulted by the DOE in preparing the estimates. This is an important issue because of Clark County's rapid population growth.

The failure to account for Clark County's population changes indicates that the DEIS underestimates risk. The DOE response will undoubtedly be that the 1990 Census remains the only official estimate of the population of Clark County. In many parts of the United States and indeed in Nevada, this is a reasonable assumption. In the case of Clark County, Nevada, however, that assumption is not reasonable. No responsible authority in the region uses the 1990 census for any planning purposes. Utilities, the school district and local planning agencies have all come to rely on the consensus estimate of the population.

The changes in Clark County's urban population have significant impacts on the exposed population considered in the DEIS. The population living within .5 miles of likely nuclear waste routes through urban Clark County using the 1990 census data is 88,745. The estimate of that same population using the year 2000-population estimate is 154,792, almost twice the 1990 population.

Even the Nuclear Regulatory Commission in its recent rulemaking, felt compelled to adjust the population figures to provide a more realistic appraisal of the public health risk. The DEIS did not take even this modest step. Based on these figures, the Department of Energy's analysis is misleading. To remedy the situation, the DOE, prepare a new EIS that uses the most relevant population figures when the 2000 Census becomes available. The current DEIS provides, at best a lower bound of the health risk.

Due to Clark County's rapid growth and uncertainties about the DOE's program, the DEIS should have based its risk estimates on a responsible forecast of population along the potential routes. There is no clear indication when the DOE will be in a position to ship high-level waste to Yucca Mountain.

The population living within .5 miles of likely nuclear waste routes through urban Clark County using the 1990 census data is 88745. The estimate of that same population using the year 2020 population estimate is 372579, more than four times the 1990 population used in the analysis contained in the DEIS. Population forecasts for the area surrounding the likely radioactive waste routes are readily available and should have been consulted in the preparation of the DEIS. The DEIS underestimates the human health effects to Nevada's population by a considerable degree.

In 1960, the State of Nevada produced tourist map of Nevada that indicates the Nevada Test Site (NTS) is 100 miles northwest of urbanized Clark County. Recent briefings by DOE staff describe the NTS as being 65 miles northwest of urbanized Clark County. This change is due to Clark County's growth. It suggests that the direction in which Clark County's urban area is growing should have been an important consideration in preparing the EIS.

The valley in which urban Clark County rests is geographically constrained. That is, the physiographic features of the region force human activity to take place in certain areas rather than others. Future population growth in Clark County must take place along potential HLW [high-level radioactive waste] transportation routes. Urban Clark County has outgrown its original bounds and one of the most contentious issues in the region is the disposal of land from the US Bureau of Land Management (BLM). The original boundaries for urban Clark County have been adjusted several times to account for this growth.

Any future population growth that occurs in Clark County will take place along likely HLW transportation routes. Because of land use plans and zoning restrictions, the nighttime population density along the beltway will be similar to the urban core densities. The only foreseeable difference in population density between the routes through Clark County will be in employment. Unfortunately, the DEIS does not consider employment population data in any of the calculations. These data are readily available from Clark County. The DEIS should anticipate the likely population growth in Clark County when preparing its risk estimates.

Past experience suggests that the center of gravity of population in urban Clark County will continue to shift to the northwest. This phenomenon has already occurred in the City of Las Vegas. It is likely that the Population growth along the route will have two effects. The first and most obvious is that the number of people exposed to radioactivity due to the proposed action will increase. The second is that the risk characteristics of the transportation routes through the area will change. The ongoing construction of homes and businesses will create heavy truck traffic and continual construction on the roads in the area. Construction zones typically increase accident rates by 50%. The DEIS fails to consider this substantial and imminent threat to public health and safety.

The special populations used for these comments are derived from the Clark County Hazardous Materials Emergency Response Plan for 1998. This report is prepared by the Local Emergency Planning Committee (LEPQ) to support emergency management activities. The sensitive population section of the report describes facilities that contain difficult to evacuate populations.

A special population of particular concern to Clark County is the nonresident population. From 1991, the number of tourists visiting Clark County grew from 23 million to 33 million. The occupants of these hotels are also at risk and should be included in the population total. Along the currently existing legal weight truck route (which for an unknown reason the DEIS did not analyze) there are 17 hotels within .5 miles of the legal weight truck route. Preliminary estimates indicate that approximately 6,000 hotel rooms are within .5 miles of potential routes through urban Clark County. Besides the human health considerations, there are two additional concerns with regard to the DEIS.

The first of these is that the nonresident population contributes to higher accident rates. Approximately 40% of the 33 million visitors to Clark County arrive by car. These drivers are unfamiliar with the road network and make a significant contribution to accidents in the valley. Most traffic accidents are caused by drivers unfamiliar with the area in which they are driving. Clark County's tourist population presents an additional accident risk that was not considered by the DEIS.

Another concern for Clark County is the problem of evacuating these nonresidents, should an accident occur. There is no discussion in the DEIS of the size of the area that may have to be evacuated or for how long that evacuation must last. The problem of evacuation in case of a radioactive emergency has been studied by the DOE and the benefits of these studies should have been applied in the DEIS. Depending on the location and size of the plume, potentially thousands of nonresidents may have to be evacuated or relocated within Clark County. The likely effect of an evacuation are considered in another section of these comments, however, it is important to point out that the problem of controlling the evacuation of a highly mobile nonresident population is extremely difficult and could easily cause impacts to the community that were not considered in the DEIS.

The DEIS does not consider the problem of radiation exposure to schoolchildren. There are currently 37 schools within .5 miles of a potential nuclear waste route in Clark County. The number of schools near these routes will increase because new schools will be constructed along the beltway to service development in the area. The risk analysis presented in the DEIS does not consider the effects of radiation on the children attending these schools. A supplemental report that presents a radiological health examination of the effects of radiation on children attending schools adjacent to nuclear waste routes should be performed.

Analysis of the Potential HLW routes indicates that the Columbia Sunrise Hospital in Summerlin is the only health facility within .5 miles of a potential nuclear waste route. No jails, group homes, drug treatment centers or senior health centers were identified. Although no special event center was identified within the .5-mile distance, Clark County believes the Las Vegas Speedway center should be considered as an effected facility. The speedway is adjacent to Interstate 15. The parking lot for the Speedway falls within .5 miles of the route. In case of an accident, it is likely that the Speedway will be affected in some way.

Response

The transportation impact analyses in Section 6.3.1 of the EIS account for population growth in Nevada. Impacts in states other than Nevada are based on 1990 census data adjusted to reflect U.S. Bureau of Census forecasts of state populations for 2025 and state census reported for 2000 and extrapolated to 2035. These forecasts account for population growth and migration of the national population and include adjustment for the 2000 Census. With the exception of areas adjacent to the Las Vegas Beltway, impacts in Nevada were adjusted using population forecasts

estimated by the REMI model (DIRS 103074-BEA 1992) using forecast data provided by Clark and Nye Counties and the Nevada State Demographer and adjusted for data from the 2000 Census.

For purposes of analysis of impacts presented in Section 6.3.1 of the EIS and to account for anticipated growth in the vicinity of the Las Vegas Beltway, DOE assumed the density of populations along the Beltway in 2020 could be represented by estimates presented in the report prepared for the City of North Las Vegas (DIRS 155112-Berger Group 2000). DOE assumed this population would grow at the same rate as for all of Clark County from 2020 to 2035. To estimate impacts, the analysis used the population along highways and railroads in Nevada forecast for 2035. Figures 6-13 and 6-20 show the Las Vegas Beltway and the proposed routes for legal-weight trucks and heavy-haul trucks that would use the Beltway. Impacts in other Nevada counties, including mostly rural counties, are adjusted using REMI-generated estimates of future populations based on data provided by the Nevada State Demographer's Office. DOE used the latest reasonably available data in the analysis for use in estimating transportation impacts.

Information on locations of schools, hotels, and other special facilities as well as the condition of existing highway infrastructure (for example, pavement condition, highway capacity, width, shoulders) is a level of precision that is not necessary for DOE to evaluate impacts and provide a reasonable estimate for each alternative in the EIS. If the Yucca Mountain site was recommended and approved, at that time, prior to constructing a branch rail line in Nevada or working with the State of Nevada to upgrade highways and constructing an intermodal transfer station, DOE would conduct additional engineering and environmental studies along with consultations with responsible Federal, State, tribal, and local authorities. Appropriate National Environmental Policy Act reviews would be conducted.

The traffic accident and fatality rates used in the environmental impact analyses (DIRS 103455-Saricks and Tompkins 1999) are the latest reasonably available consistent data applicable for use in estimating impacts of transportation accidents. The data are state-specific and have been divided into accidents by road type in each state. The accident rates are developed from data taken from all areas of a given state and include accidents that occur in areas with high accident rates (for example, they include the effects of tourists on accident rates in the Las Vegas area) as well as areas with lower rates. Thus, although the results might not predict the impacts in specific areas precisely, the aggregate total impacts both nationally and within Nevada, on average, are accurate. This level of precision is all that is necessary to support the decisions to be made from this EIS.

With respect to the comment on evacuating hotels in the event of a radiological accident, State and tribal officials have the responsibility to protect persons, the environment, and property within the State or reservation from unwarranted radiation exposure or consequences of radioactive material contamination. As discussed in Section 6.2.4.2 of the EIS, if requested by a state or tribal authority, DOE would provide assistance from its Regional Coordinating Offices located across the United States to reduce the consequences of accidents related to the transportation of spent nuclear fuel and high-level radioactive waste to Yucca Mountain. The assistance would include providing equipment, logistical and medical resources, and qualified personnel as necessary. States and tribes can request and obtain assistance from other Federal agencies including the Federal Emergency Management Agency, Environmental Protection Agency, Nuclear Regulatory Commission, Department of Transportation, and Department of Defense. Under Section 180(c) of the NWPA, financial and technical assistance can be made available for emergency response training and preparation of emergency response plans. A portion of these funds can be used for equipment. Additional information on emergency response is provided in Sections M.3.2.2.5 and M.5.

The EIS expresses radiological health impacts as the incremental changes in the number of expected fatal cancers (latent cancer fatalities) for populations as well as the incremental increases in lifetime probabilities of contracting a fatal cancer for an individual. The estimates are based on the dose received and on the dose-to-health-effects conversion factors recommended by the International Commission on Radiological Protection. The Commission estimated that, for the general population, a collective dose of 1 person-rem would yield 0.0005 excess latent cancer fatalities. This value includes the effects on pregnant women, children under the age of 18 years, and the elderly.

8.8.3 (10345)
Comment - EIS001543 / 0005
I'm concerned about the health impact and I'll conclude with this statement. I'm concerned that the 10th district, which I represent, and beyond the 10th district is being asked to accept a massive increase in transportation and

radiological risks to transport this waste in an expedited manner to the satisfaction of the nuclear industry. While you're called upon to handle this problem with Yucca Mountain, we have a major problem in our energy policy because this waste is going to keep being created. And unless we start to look at the development of new energy technologies so this Country can transit from this wasteful and dangerous nuclear technology, which future generations will be saddled with, we will have done a disservice if we don't find other ways to create energy.

Now, this Draft Environmental Impact Statement fails to fully inform my constituents of the risks of this waste. According to the testimony from the State of Nevada, which we were able to obtain for purposes of filing a response to the DEIS. The typical characteristics of waste to be transported contained 31,000 curies of cesium-137, 21,000 curies of strontium-90 and as a powerful source of penetrating gamma and neutron radiations. A surface dose rate is estimated to at least 10,000 REM per hour or about 166 REM per minute. A person standing or sitting next to unshielded assembly that would be containing this waste would receive, at least, 100 REM per minute. And I think people would want to know if they're getting dozens of free x-rays as they're moving through traffic, as they're sitting in their living rooms with trains passing by. These issues must be looked at to protect the public health.

The first concern here should not be the transportation of nuclear waste, the first concern should be the public's health and when you can secure the public's health, without any question and in doing that through public hearing, that's the point at which I think it's logical to have a discussion about the transportation of this waste.

Response
Appendix J of the EIS has been revised to include maps of the truck and rail routes used in the analysis of impacts, the estimated number of shipments, and the estimated impacts for each state through which spent nuclear fuel and high-level radioactive waste transport was analyzed. The impacts in a particular town or city in a state would be less than those for the state. These are estimates for analyzing transportation impacts in the EIS and the actual routes, the number of shipments, and impacts for these states could be different depending on the actual routes that are chosen.

Unshielded spent nuclear fuel can be hazardous and for this reason spent nuclear fuel is shipped in heavily shielded casks. The maximum radiation dose rate from a spent nuclear fuel cask is about 10 millirem per hour at 2 meters (6 feet) from the side of the transporting vehicle. The radiation doses from shipping spent nuclear fuel and high-level radioactive waste are presented in Sections 6.2 and 6.3 of the EIS. The average radiation dose to people along transportation routes would be about 0.1 millirem over 24 years. This is equivalent to a lifetime risk of fatal cancer of 1 in 20 million. For perspective, the risk of fatal cancer from all causes ranges from 1 in 4 to 1 in 5.

In relation to public involvement in transportation planning, Section M.3.2.1 of the EIS describes the process by which transportation routes would be selected and transportation plans developed. Routes would be selected in accordance with U.S. Department of Transportation regulations and approved by the Nuclear Regulatory Commission. DOE would approve the Regional Servicing Contractor's plans prior to their submittal to the Commission for approval. In addition, at least 4 years prior to the first shipment, in the course of implementing its policy and procedures for Section 180(c) of the NWPA, DOE would notify potentially affected states and tribes of its preliminary determinations of routes that would pass through the state or tribal jurisdictions.

8.8.3 (10996)
Comment - EIS001952 / 0011
Sliding scale in calculating less harm to rural populations from accident/incident/non-event exposures from routine transport supports de-facto transportation routing through rural areas. At the same time, rural areas are receiving considerable monetary and infrastructure incentives to grow/increase populations which will actually be exposed when transportation begins. As incentives, rural areas are promoted as tourism centers which increases likelihood that non-resident populations will also be exposed to risk of transport in rural areas. The inconsistency is similar to the Las Vegas area which is promoted as one or the fastest growing populations in the nation--for tourism and real estate purposes--but, is a desert with sparse population during discussions as to where to site a HLRW [high-level radioactive waste] site!

Response
As stated in Section 2.1.3.2.2, routes for national and Nevada truck transportation were selected for the purpose of analyzing impacts in the EIS. These routes are representative of routes that would ultimately be used. At this time,

years prior to when shipments could begin, DOE has not selected routes for transporting spent nuclear fuel and high-level radioactive waste to a Yucca Mountain Repository. The routes used in the analysis were selected in accordance with U.S. Department of Transportation's highway routing regulations in 49 CFR 397.101. These regulations require the use of the Interstate Highway System for transporting spent nuclear fuel and high-level radioactive waste and selection of routes that would reduce time in transit. A key element of the regulations is that reducing time in transit would reduce radiological risk, and thus the emphasis on use of Interstate System highways. In rural areas, traffic generally flows freely at highway speeds and there are fewer delays and less traffic than suburban and urban areas. In addition, there are fewer people in the vicinity of the shipments in rural areas than suburban and urban areas, which would lead to lower radiological impacts. The radiological exposures to maximally exposed individuals, as shown in Sections 6.2.3 and 6.2.4 for the national mostly legal-weight truck scenario, would be well below the exposures for which any health effects would be expected. These impacts are stated as being a total of 6 millirem over 24 years (3-in-1-million chance of a lifetime latent cancer fatality) for legal-weight truck transport and 0.75 rem (about 4-in-10,000 chance of a lifetime latent cancer fatality) for a maximum reasonably foreseeable accident involving a legal-weight truck cask. Regardless of whether a person was a tourist, nonresident, or resident or whether a person lived in a rural, suburban, or urban area, the maximum incident-free and accident radiological exposures calculated in the EIS would lead to small impacts.

8.8.3 (11861)
Comment - EIS000764 / 0003
Since the Private Fuel Storage [PFS] project will transport its customers spent nuclear fuel to the storage facility by rail, the conclusions reached by DOE in the DEIS concerning transportation are relevant to the PFS project. For the last fifteen or so years, I have been actively supporting the ability of the nuclear industry to safely transport spent nuclear fuel. And the conclusions of the DEIS serve to re-enforce the fact that spent nuclear fuel has and can be transported safely and efficiently.

There has been ample historical evidence that safe, routine transportation of spent nuclear fuel can be accomplished. For more than three decades, the domestic nuclear industry has conducted almost three thousand shipments of spent nuclear fuel without a release of radioactive material or a failure of the transport cask. This is a remarkable safety record. I believe this is not the result of chance, but the result of a comprehensive federal regulatory regime of cask design criteria and certification regulation, and transportation regulation, and the conscious effort of the nuclear industry.

As I mentioned before, the conclusions of the DEIS with regard to transportation have relevance to the PFS project which is currently in the licensing process with the Nuclear Regulatory Commission. While the transportation of spent nuclear fuel to the PFS project from our customers is the subject of a separate NRC [Nuclear Regulatory Commission] licensing process, any future shipments to the repository from the PFS facility would be bounded by the evaluations of this DEIS.

Response
DOE agrees with the commenter's remarks about the safety record of shipments of spent nuclear fuel. Section 6.2 of the EIS provides a discussion of transportation impacts related to the potential use of the Private Fuel Storage Facility. Section J.4 provides a map of Utah showing the location of the Private Fuel Storage Facility in relation to transportation routes used in the analysis. Section 8.4 reports the cumulative impacts of the Private Fuel Storage project.

8.9 Transportation Costs

8.9 (193)
Comment - 13 comments summarized
Commenters stated that the EIS does not adequately analyze the impacts to rail lines and highways from the transport of spent nuclear fuel and high-level radioactive waste to Yucca Mountain, nor does it describe the agencies that would pay for transportation-related improvements, mitigation, and monitoring. Commenters said that these are important issues because transport would last several decades. Some said that it is DOE's responsibility to make sure that all needed upgrades of infrastructure are done.